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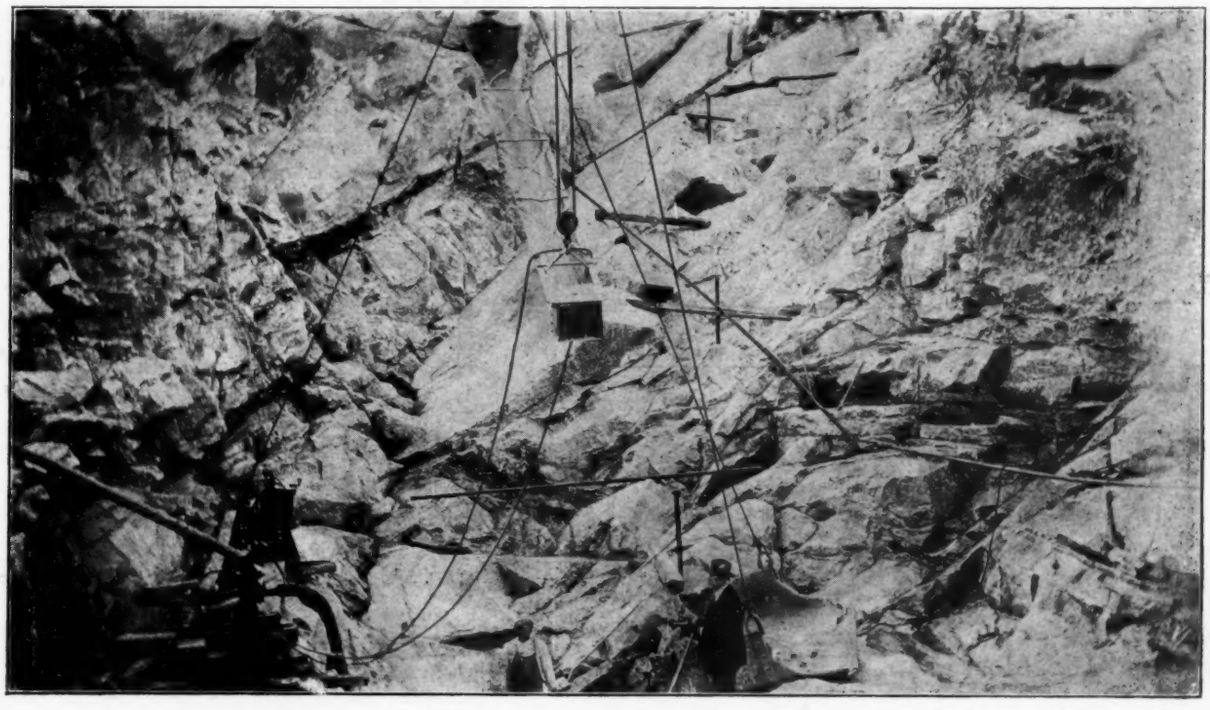
PUBLIC WORKS

CITY COUNTY STATE



BOTTOM OF EXCAVATION FOR BARRETT DAM OF SAN DIEGO'S WATER SUPPLY

At the top center is seen a movable chute for the discharging of the concrete, which is about to begin.

IN THIS ISSUE

Building San Diego's New Water Works Dam

Recent Developments in Water Works Matters

Granite Block Pavement

Convention of the American Society for Municipal Improvements

Inverted Siphons for Sewers

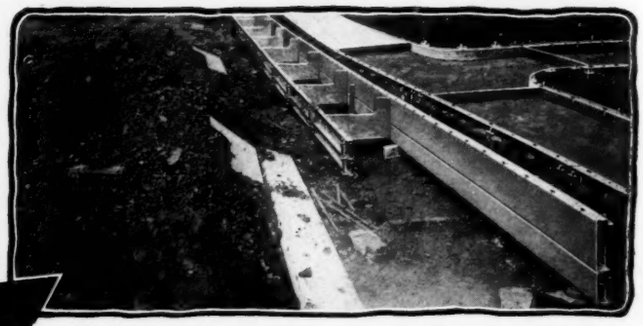
Sludge Handling at Rochester

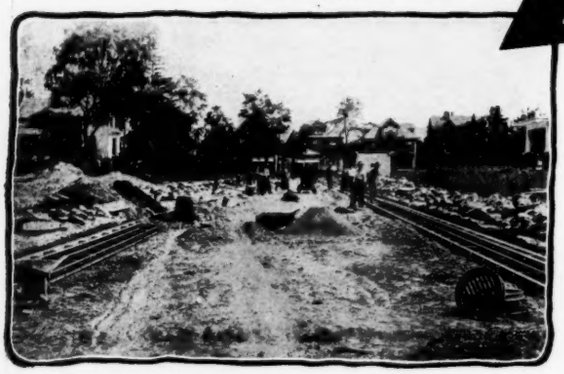
NOVEMBER 5, 1921

Curb and Gutter Forms

BLAW-KNOX

Collapsible Dividing Plate for Battered Curbs.





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CITY COUNTY STATE

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Vol. 51 NOVEMBER 5, 1921 No. 19

Building San Diego's New Water Works

By Allen Henry Wright

Rock carried from quarry to dam by gravity, through crushers, screen, mixer and chutes, a distributing tower being necessary for distributing the concrete in the further and higher parts of the dam.

Of unusual interest, from an engineering standpoint, is the efficient manner in which gravity is utilized in the construction of Barrett dam, on the water impounding system of the city of San Diego, Cal.

The Barrett dam is situated on the Cottonwood river, 36 miles easterly from the city, and the work is being carried on with city forces under the municipality's hydraulic engineer, H. N. Savage, who completed about two years ago the Lower Otay dam, another unit of the city's water system.

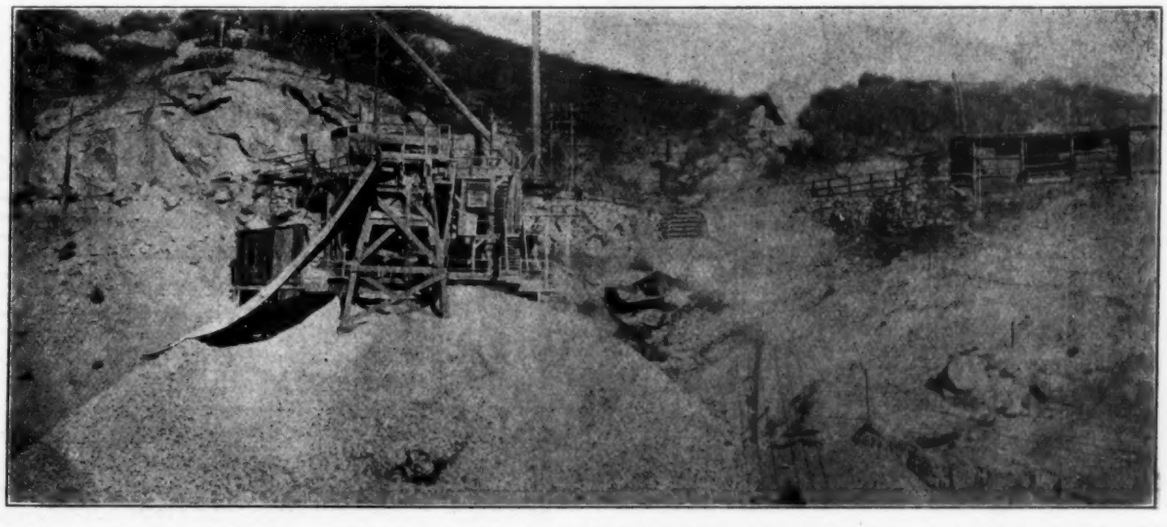
The dam, which will impound 14,000,000,000 gallons of water, was started on February 1, 1920, under a bond issue of $1,000,000, although preliminary work had been under way for two months prior to that. A subsequent bond issue of $500,000 was voted in April last for the completion of the construction.

It is the estimate of the hydraulic engineer that the dam will contain approximately 136,000 cubic yards of concrete masonry, having a weight of 287,000 tons.

The placing of concrete began July 15, 1920, following the clearing of the dam site of all loose and unsuitable material down to solid granite bedrock, the rock and earth excavation for the foundation and abutments of the dam aggregating 66,000 cubic yards. The cement required for the entire job will be about 130,000 barrels.

It is the purpose of this article, however, to deal particularly with the utilization of gravity upon this project.

The Cottonwood river, at the dam site, runs through a narrow gorge, with high, rocky canyon walls, and it is from a point high above the work that the engineer opened up a quarry to furnish the rock for the masonry. He states that the Barrett project is being carried on under the



QUARRY (IN BACKGROUND), CRUSHER BUILDING, DISCHARGE END OF CONVEYOR AND PILE OF BROKEN STONE (IN FOREGROUND)

best quarry conditions he has known. The material secured is a perfect, typical granite of medium grain and medium hardness.

When the quarry was first opened it was found that the surface rock was somewhat decomposed and hence not usable. After this class of material had been quarried and spilled over the canyon sides below the dam site, drillers were set at work preparing for the powdermen. For the big blasts, a battery of six 6-inch diameter holes, spaced about 20-foot centers, were drilled from 100 to 150 feet deep in the rock wall, filled with 40 per cent bag powder, and set off, the big blasts throwing down about 25,000 cubic yards of rock.

The rock thus obtained by blasting is broken up at the quarry by smaller blasts and by hammer into sizes up to 16 by 24 inches, not to exceed 4 feet in length, and hauled by one-horse two-wheeled carts, carrying detachable skips of a capacity of 1½ cubic yards, to the crusher, which is located 400 feet above the construction work.

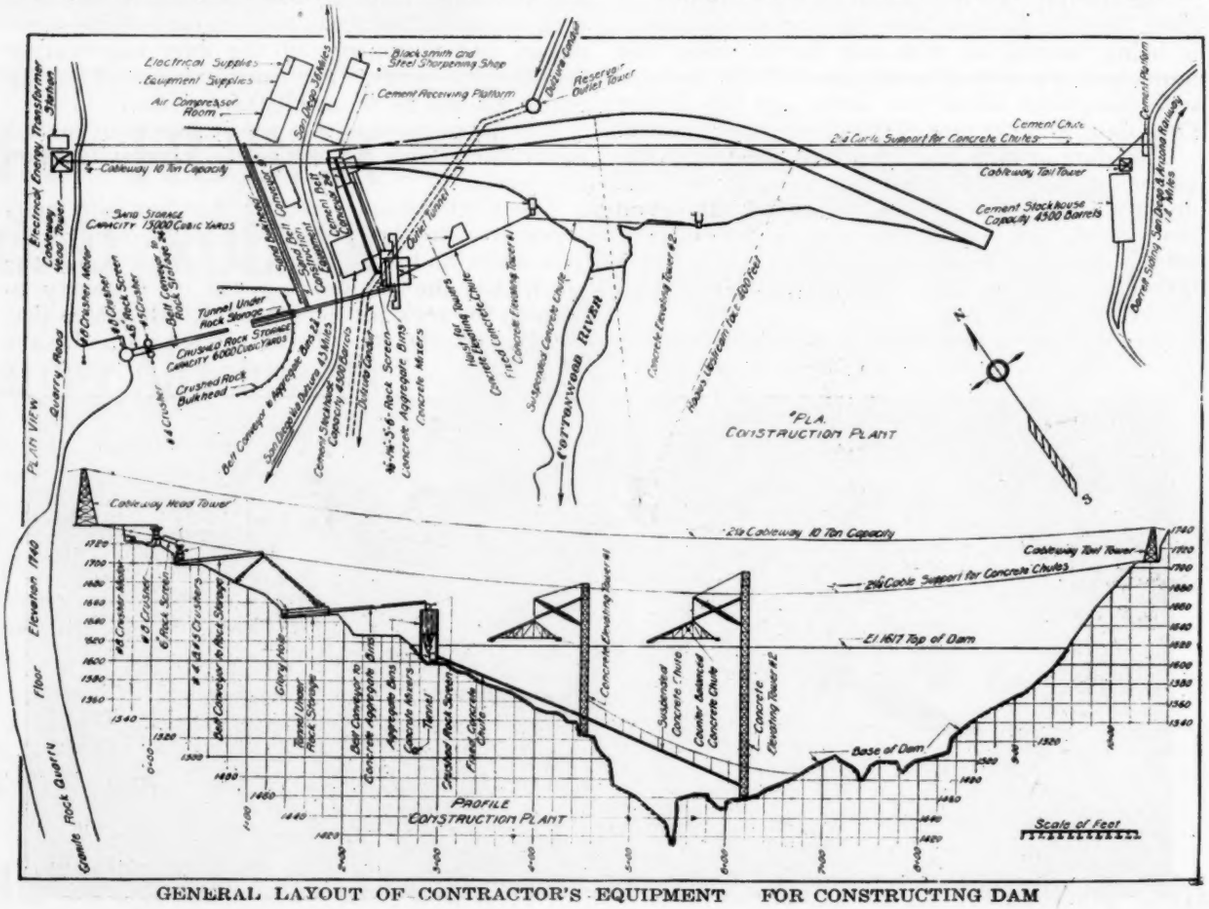
The crusher is of the gyratory type, an Austin No. 8, with manganese steel mantle and concaves of the same material. Up to October 1 this crusher had handled over 90,000 cubic yards of rock without a break. To lay and conserve the rock-dust, a water-spray is played on the rock as it enters the crusher.

After passing through the crusher, the rock goes down to a set of screens where the material is separated into various sizes, from sand up to anything that will pass through a 6-inch screen, even though its longest dimension may run to 14 inches.

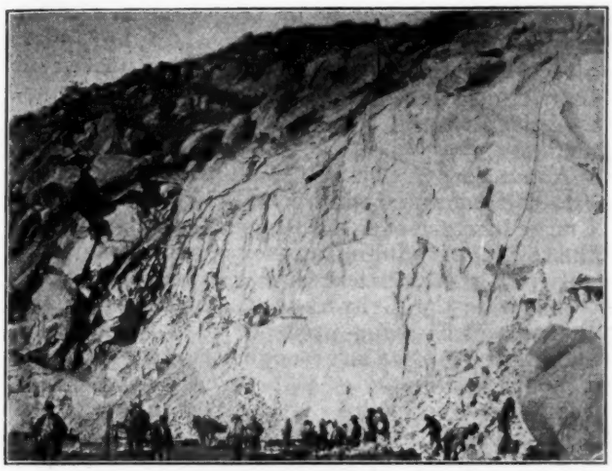
Rock pieces of larger size are automatically passed by gravity to a secondary, No. 4, crusher, Gates type, also gyratory, and after being broken into smaller sizes the material is carried out by conveyor belt to the rock stock pile, where it feeds, through the "glory-hole," to another conveyor which carries the crushed rock to the top of the mixer bin, where, in their proper proportions, the ingredients pass into a Milwaukee mixer, with a capacity of 81 cubic feet dry mix.

Again gravity enters into the work, as it has from the start at the quarry, and the mixed concrete flows through a metal-lined chute directly to its final place in the base of the dam, or to the hoisting towers where the buckets are raised to any desired height, according to the progress of the work, and then dumped into adjustable metal chutes, from which the concrete can be deposited as desired in the higher portions of the dam, the material feeding from the chutes by gravity.

Practically one-half of the sand used on the job is obtained in the process of rock crushing, the remainder of the sand being taken from a stock-pile which had been hauled from the stream-bed above the dam in the early stages of the work on the project. In order to conserve the sand and crusher dust as the material passes down from the first crushed-rock conveyor, canvas screens are so placed as to retain all of the finer material,



GENERAL LAYOUT OF CONTRACTOR'S EQUIPMENT FOR CONSTRUCTING DAM



FACE OF QUARRY FROM WHICH CONCRETE STONE IS OBTAINED

which might otherwise be blown away down the canyon.

Water for the construction work and the camp is obtained from the Cottonwood river, and so, with the rock and sand right at hand, the only element entering into the material used in the dam which has to be brought in is the cement, and this is hauled, over specially constructed roads, from a siding on the San Diego and Arizona railroad, 14 miles distant.

In preparing the camp site for the work, it was necessary to construct two cement stock-houses, each of a capacity of 9,000 barrels; a blacksmith shop; two spouting towers of 160 and 182 feet, respectively; a warehouse; recreation building, offices, five bunk-houses, 25 cottages for married employees, and other features. The camp has a telephone system, domestic water supply, a septic-tank sewer system and a high-pressure fire protection.

About 175 men are employed on the project, and the average amount of masonry placed for each 8-hour shift, with a single mixer, is 280 cubic yards, with a record amount of 387 cubic yards for a single shift.

Electricity is used for power in all stages of the work, from the generation of the compressed air for the quarry drilling down to the hoists on the dam, but wherever gravity can be utilized in the moving of material it is so employed, and in this way the cost of the construction is greatly reduced. Engineer Savage reports that the cost per cubic yard of material placed is $6, this including the cost of cement and all plant daily operation and overhead.

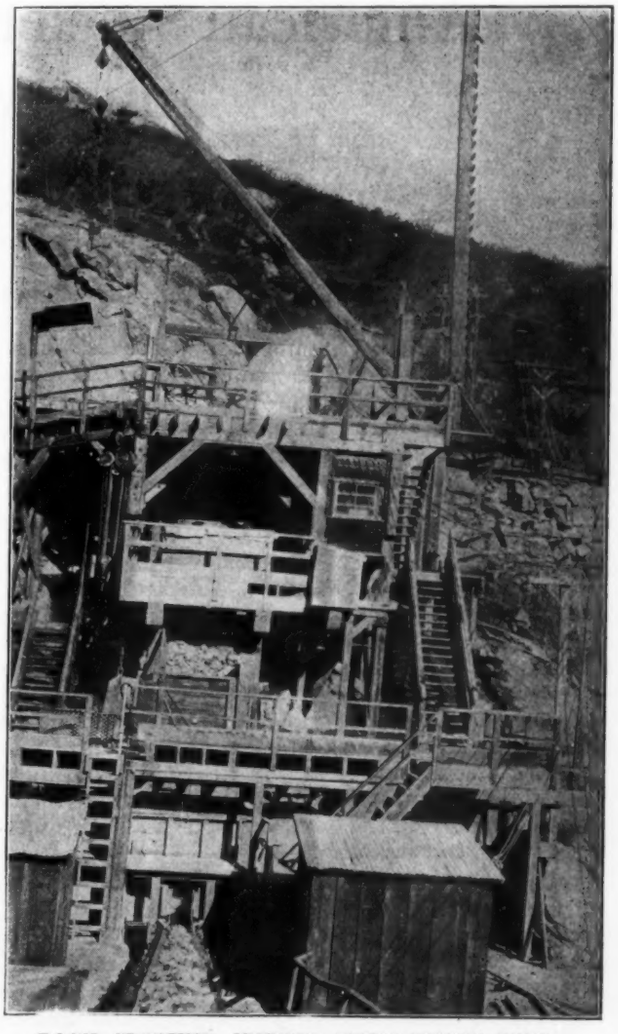
Sanitary Engineering Inspections of the Health Institute

In connection with the Health Institute to be held in New York during November, as previously announced in PUBLIC WORKS, a program has been drawn up for inspections to be made by the Sanitary Engineering section, the chairman of which is Kenneth Allen, of the New York City Board of Estimate and Apportionment, the other members of the committee including M. N. Baker, George W. Fuller, George T. Hammond, F. E. Hale and Charles V. Craster.

On November 8 there will be an inspection of the Newark hog farm under the courtesy of J. W. Costello, chief of the Bureau of Highways of Newark. After returning from this there will be symposiums at the American Museum of Natural History on garbage disposal and on harbor pollution.

On November 9 there will be an inspection of the Mt. Prospect laboratory of the Bureau of Water Supply of New York, which is located in Brooklyn, this being by the courtesy of Col. Merritt H. Smith, chief engineer of the bureau. In the afternoon there will be an inspection of the Kensico dam with its chlorination and aeration plants, this also by the courtesy of Col. Smith. From here a limited number will be taken by automobile, through the courtesy of W. W. Brush, deputy chief engineer of the bureau, to the Mt. Kisco sewage disposal plant.

On November 10 there will be in the morning an inspection of the Little Falls filtration plant by the courtesy of A. W. Cuddeback, superintendent and engineer of the Passaic Water Co., and



ROCK CRUSHER, VIEWED FROM STONE PILE
At the bottom is seen the belt conveyor removing stone from the lower crusher to the stone pile

from here to Wanaque, where the dam foundations will be inspected through the courtesy of Arthur H. Pratt, chief engineer of the North Jersey District Water Supply Commission. At this dam a light lunch will be served by the contractor, Walter H. Gahagan.

On November 11 the morning will be devoted to an inspection of the Dyckman street sewage screening plant by courtesy of W. E. Duy, engineer in charge of maintenance. In the afternoon there will be an inspection of the East 139th street refuse dump and an exhibit of the street cleaning apparatus at the East 24th street yard, through the courtesy of John P. Leo, commissioner of street cleaning.

Portland Cement Output

The shipments of Portland cement during July, August and September of this year reached approximately 33,970,000 barrels, establishing a record for this quarter. The amount produced in September also established a record for that month, being 10,027,000 barrels of finished cement. These figures, which were prepared under the direction of Ernest F. Burchard, of the United States Geological Survey, when considered in connection with the low demand for other commodities, showed a remarkable demand for cement.

About 20 per cent of the output is now going into the construction of concrete roads, which is a large increase over former periods. In addition, the revival of building activity is under way probably to a greater extent than is generally realized. Aside from the highway work, the larger part of the cement is being used on small to moderate sized jobs, as few large engineering projects are under way.

Wholesale prices of Portland cement per barrel, without bags, in carload lots, ranged as follows during September, the lower quotation in each case being that for the last few days of the month. At New York $2.69 to $2.75; at Chicago $1.97 to $2.17; at Minneapolis, $2.26 to $2.41; at Denver, $3.10; at San Francisco, $2.89 to $3.09; at Seattle, $3.10; at Atlanta, $2.69 to $2.75; at Dallas, $2.80; at Montreal, $3.10.

American Society for Municipal Improvements

Doings of and at the twenty-seventh annual convention. Reports of committees, papers on paving, sewerage, water supply and other phases of municipal public work.

The twenty-seventh annual convention of this society at Baltimore last week was attended by an unusually large number of members, there having registered 162 active members, 78 associate and affiliated, and 279 guests, a total of 519. Three hundred had registered when the convention was called to order on Tuesday morning. Notable was the presence of fourteen past-presidents.

Several score were present at the sectional meetings of the General Specifications Committees on Monday to discuss specifications. Especially animated was the discussion of the brick specifications, the subject of plain and lug wire-cut brick occupying much of the time; also the sewer specifications, where classification and measurement of material excavated in trenches and other proposed changes were discussed. These discussions in committee were continued Tuesday morning. Some of the committee members had arrived the week previous and held meetings on Saturday and Sunday.

The convention held regular sessions for the discussion of papers on Tuesday afternoon, Wednesday morning and evening, Thursday morning and afternoon, and Friday morning. Tuesday evening the Baltimore Country Club gave a reception and dance to the society members and guests. Wednesday afternoon was spent in a boat ride and inspection of the harbor. On Thursday evening they were entertained by the Press Club at the Lyric Theatre, where was given an entertainment that included vaudeville, and addresses by Senator King, of Utah, and Philips Lee Goldsborough, former governor of Maryland.

The convention proper closed on Friday noon, although quite a number remained to take an automobile trip around Baltimore and its public works.

NEW OFFICERS AND PLACE OF MEETING

The officers elected for the coming year were as follows:

President—E. S. Rankin, of Newark, N. J.

First Vice-President—W. W. Horner, of St. Louis, Mo.

Second Vice-President—Ellis R. Dutton, of Minneapolis.

Third Vice-President—H. H. Smith, of New York.

Secretary—Chas. Carrol Brown, of St. Petersburg, Fla.

Treasurer—Linn White, of Chicago.

Finance Committee—E. L. Dalton, of Dallas; S. C. Corson, of Norristown, Pa.; and Joshua Atwood, of Boston.

Cleveland was chosen as the next place of meeting.

Some of the members from Texas and other distant points left for home on Thursday in order to reach there before the threatened strike could interfere.

Secretary Brown, whose home is at St. Petersburg, Fla., was asked, but what is said to be the first message to leave that stricken city, to return there to aid in immediate repair of the damage done by the storm. He left on Wednesday and his duties on Thursday and Friday were taken over by A. Prescott Folwell, editor of PUBLIC WORKS, who had been Mr. Brown's predecessor as secretary.

RESOLUTIONS

Two general resolutions were introduced through the Resolutions Committee, one by which the society heartily endorsed the aims of the Conference on Armament Limitation, expressing earnest hope that the results which it is desired to obtain by this conference be realized; the other instructing the Committee on Sewerage and Sanitation to give special consideration during the coming year to the subject of the ultilization of sludge as a fertilizer and to urge the secretary of the Department of Agriculture to investigate, through the Bureau of Soils, the practicability and methods of utilizing sewage sludge as a fertilizer. It is understood that the American Public Health Association, at its annual meeting in New York in November, will be asked to take similar action.

The program was an unusually full one, more than 70 reports and papers being scheduled for the six sessions, but it was carried through with very few changes and only once was it found impossible to keep up to the schedule. The crowded condition of the program, however, had much to do with shutting off discussion, of which there was practically none in the convention proper, although considerable had been held previously in connection with the paving and sewerage specifications at the public hearings given by the committees having charge of the several specifications.

EXHIBITS

There were as usual a considerable number of exhibits, totaling 37 in number. The greater part of these were arranged in booths around the convention hall and it therefore was imperative either that no use be made of the booths while the convention was in session, or that the meetings be subject to great annoyance from conversation in the booths. It is to the great credit of the exhibitors that no annoyance whatever was created by them; but because of this they derived practically no benefit from their exhibits, since the convention was in session practically the entire time; in fact, some of the booths were not even visited during the entire convention by those who leased the spaces. This was a hardship to the exhibitors which would seem to be uncalled for and it is to be hoped that in future conventions the combining of exhibits and meetings in the same room will not be considered.

During Thursday there was a gathering in Baltimore of the mayors of a number of cities, at the invitation of Mayor Breuning, who organized a permanent body to be known as the "Annual Conference of American Mayors." At the request of this organization, a committee from it and from the A. S. M. I. will consider, during the coming year, a proposition for the holding annually hereafter of concurrent conventions of the two organizations, with probably one joint meeting.

NARRATIVE OF THE CONVENTION

TUESDAY'S SESSIONS

Mayor W. F. Breuning, in his address of welcome, after calling attention to the wonderful progress made by Baltimore since the fire in carrying out a program calling for more than $100,000,000 of municipal funds, emphasized the importance of its efforts to minimize unemployment. Last year a municipal emergency bureau was created in anticipation of the present condition, and plans prepared for emergency employment of labor on public work that, while needed, was not pressing. On this work 30 cents an hour is paid, while 45 cents is paid to those on the regular payroll; the aim being to retain on emergency work none who could find public or private work at higher wages, many of them not being able to really earn even 30 cents.

Major Whitman then outlined what the local convention committee had prepared for the entertainment of the convention. Vice-President Rankin replied in a brief and happy speech to the mayor's welcome, and Col. Compton delivered the president's annual address, in which he expressed the hope that the society would take some action looking to a relief of the unemployment.

Secretary's Report

The secretary read his report, showing a net gain in membership of 36 during the year, and a reduction of the society's deficit by $1,130. The report showed that the membership during the year ending October 1, 1921, changed as follows:

Active: net increase from 457 to 483, there having been 106 added and 80 lost.

Affiliated: net increase from 24 to 35, there having been 15 added and 4 lost.

Associate: net increase from 130 to 130, there having been 30 added and 30 lost.

Total: net increase from 611 to 648, there having been 151 added and 114 lost.

The receipts during the year comprised $2,384,75 as dues from active members, $242.50 as dues from affiliated members, $932.50 as dues from associate members, $301.47 from sale of Proceedings, $19.01 from sale of specifications, $618.27 from advertisements and $1,057.50 miscellaneous; a total of $5,556. There were also received $97.77 interest on Liberty Bonds and bank interest and $49.13 received from the previous treasurer. The large "miscellaneous" item included $800 donated to the society by the local committee of the St. Louis convention, being the balance in its hands after the convention, and $200 was a rebate on the printer's bill which had already been paid. About $50 was contributed by the authors of papers to pay for the cuts used in illustrating them. The society also has an investment of $1,500 in Liberty Bonds.

A year ago there was a deficit of $1,630, and this had been reduced to $500 on October 1, and enough has since been received to more than wipe this out.

About $500 was paid before October 1 on the dues for 1922, and thus will diminish next year's income by this amount; but the dues for that year have been increased to $7.50 and the increase should more than make up for this.

The Executive Committee voted to use the $800 received from the St. Louis committee as an endowment, the interest to pay the dues for five municipal delegates to the society representing that city.

The expenditures included $1,014.66 for office and miscellaneous, $600 for secretary's salary for two years, $401.31 convention expenses, $3,096.50 for printing Proceedings (40 per cent of this for those of the previous year), $121.25 for letter ballot, $78 for committee expenses and $5 Clearing House expenses—a total of $5,316.72.

Committees were then elected as follows:

On Nominations—Fred Giddings, E. A. Kingsley, G. W. Tillson, W. A. Howell, C. Arthur Poole. On Place of Meeting—W. A. Howell, H. H. Smith, E. L. Dalton, T. C. Hatton and Albert Bastis. On Resolutions—A. P. Folwell, E. A. Fisher, H. C. Allen, W. W. Horner, J. W. Hackney.

In the afternoon three excellent papers on street lighting, illustrated by lantern slides, were read, in addition to the report of the Committee on Street Lighting, which, having been printed in the advance papers, was read by title. E. A. Anderson, of the Engineering Dept. of the National Lamp Works, discussing the subject of "Street Lighting and Public Safety," cited instances where increasing the brilliancy of lighting of cities had reduced the number of crimes and also of street accidents, and produced figures to show that a large percentage of street accidents occurred at night.

"Statistics gathered from 32 cities," declared Mr. Anderson, "shows that 31,000 accidents occurred last year. Of these about 9,000 occurred after nightfall. Investigations revealed the fact that 17.6 per cent of these night accidents were caused by insufficient illumination. There were 567 persons killed in these accidents.

"In these 9,000 accidents there was a loss of $54,000,000, whereas the cities in which they occurred spend only $50,000,000 annually for street illumination."

Mr. Anderson said the cities are spending little more now per capita for street illumination than they did a number of years ago.

C. A. B. Halvarson, Jr., of the General Electric Co., gave facts, figures and illustrations relative to the development of street lighting units from the first open arc lamp to the latest type of incandescent, and special lamps designed for highway lighting.

L. A. S. Wood, manager of the Illuminating Section of the Westinghouse Electrical & Manufacturing Co., dealt in his paper with "Ornamental Street Lighting." The poles and lamps should appear well by day. For the former, cast iron was more durable than either steel or concrete and more subject to ornamental treatment. Concrete unless made very heavy, was apt to crack and check, and was chipped by occasional accidental blows.

Charles F. Goob, chief engineer of the Electrical Commission of Baltimore, described the electrical conduit system of that city, which was the first municipal system to be constructed and is now the largest in the world. It contains the wires of 19 paying and 4 free services, and the rentals pay 7 per cent on the cost after deducting interest and sinking fund charges.

D. J. Sweeney, city clerk of Buffalo, N. Y., and chairman of the Committee on Public Markets, presented the report of that committee in abstract. The committee found only one city actually selling food at a municipal stall, and comparatively no farmers using municipal markets. Moreover, prices were seldom lower and often higher than in the regular food stores, the attraction to buyers being the assembly of all foods in one place; and the food was in a less sanitary condition than in stores because more exposed to dust. Under present conditions there seemed to be little to recommend public markets.

Nicholas S. Hill, as chairman of the Committee on Water Works and Water Supply, read a report that constituted a remarkably complete summing up of the recent trend in water works matter in all branches—pumps, purification, rates, etc. An abstract of this report will appear in PUBLIC WORKS in a week or two.

WEDNESDAY'S SESSION

At the morning session, two papers were read, illustrated by lantern slides, describing the water works of Baltimore; J. W. Armstrong dealing with the securing and purifying of the supply and V. Bernard Siems with the pumping stations and distribution system, preceded by a history of the city water works for 125 years. The watershed is now being planted to white pine and spruce. The yield of the watershed has been known to fall to about fifty million gallons a day, while the consumption is about ninety million, and a considerable increase in storage is necessary, which is being obtained by raising the Loch Raven dam 52 feet higher. Other changes will be made and plans are under way for enlarging the filtration plant.

The various pumping plants are being changed over to electric, only two steam plants remaining. In the large areas absorbed into the greater city the water was formerly supplied by private companies, some of which have been bought up but ten private companies still supply about 75,000 of the population.

Spurred on by threatened water shortage, the city has been conducting a waste reduction campaign. A Pitometer survey was begun in July, 1920, and the leakage stopped by this means has totaled already about six million gallons a day, at a total cost for the survey and for repairs of valves, leaks, etc., of $20,000. Meantime a house to house survey has been carried on, by which means a waste of five million gallons a day has been found and stopped.

Mr. Siems also described the use of appliances in construction and maintenance of the distribution system, of which the readers of PUBLIC WORKS were informed in the issue of July 16.

Following these papers, T. Chalkley Hatton read the report of the Committee on Sewerage and Sanitation, of which he was chairman, summarizing briefly the subject matter of the papers prepared for that committee by Langdon Pearse, on

"Organization of Metropolitan Districts," Kenneth Allen on "The Sanitary Condition of New York Harbor," and John F. Skinner on "Sewage Disposal for Small Municipalities." In the first of these, Mr. Pearse has collected references to numerous laws, procedures and organization methods that will be of great value to any who may undertake the organization of a metropolitan sewerage, water, lighting, etc., district. (Abstracts of the papers by Messrs. Allen and Skinner and of one on "Dewatering of Sewage Sludge" by Mr. Hatton, will be published in PUBLIC WORKS.) Following this, a paper on "Sludge Handling at the Rochester Sewage Disposal Plant" was read by N. Adelbert Brown. (This paper is published in this issue.) Papers on "Public Comfort Stations," by H. F. Bascom, and "Retention of Portion of Estimates on Contract Work," by E. S. Rankin, were read by title, having been published in the advance papers.

In connection with his report, Mr. Hatton submitted a resolution as follows:

WHEREAS, The rapid increase of sewage disposal plants in the United States is bringing to the attention of municipal officers the desirability of more economic and sanitary methods for disposing of the sludges produced from these plants; and

WHEREAS, Recent developments in the art indicate that the problem may be best solved in many cases by the conservation and utilization of the fertilizing values contained in sewage sludges and

WHEREAS, There is no one municipality properly equipped to make a general study of this problem, which is essentially a service for which the Federal Government is especially equipped to perform; therefore be it

Resolved, That the general committee on Sewerage and Sanitation of this Society be requested to make special efforts, during the coming year, to collect and compile detail statistics relating to the production and disposal of sewage sludges within the United States and Canada; and, on behalf of this Society to bring to the attention of the Secretary of Agriculture of the United States the problem of sludge disposal, requesting his co-operation in making prompt and exhaustive investigations of the possibility of conserving and making available to the agricultural interests the fertilizing values contained in sewage sludges produced from all sewage disposal processes established in the United States

This was later reported favorably by the resolutions committee, and was adopted by the society.

(To be continued)

Medical Society Meets in Sewage Plant

The Medical Society of Northampton county, Pa., chose an unusual place of meeting for its regular monthly meeting of October 18, which was held in the sewage disposal plant at Allentown, Pa., the plant which was described in our issue of October 8. An inspection of the disposal plant was one of the features of this meeting, although the discussion of the meeting was on the subject of "Hysteria," which would appear to be in no way connected with the subject of sewage disposal.

Designers of Sherman Island Dam

The attention of PUBLIC WORKS has been called to the fact that the engineering staff of the International Paper Co. should have been mentioned as the designers of the Sherman island dam development which was described in the issue of PUBLIC WORKS for October 22. We take pleasure in publishing this supplementary note in order to give these engineers the credit due them.

Sludge Handing at Rochester*

By N. Adelbert Brown†

Imhoff tank sludge dried on beds and sold to farmers. Details of operation.

The sludge beds at the Rochester plants were designed on the generally accepted rule of one square foot to three persons, and under the local climatic conditions this area has proven satisfactory. The Irondequoit plant handles combined sewage. The ten Imhoff tanks are preceded by grit chambers and Reinsch-Wurl screens and are designed to serve 200,000 persons. There are 40 individual beds, each approximately 44 feet square. The tanks are built in double units with a common sludge trough. This trough is on the wall between two rows of four beds, allowing the sludge from any tank to be diverted to one of eight beds. The troughs have a slope of one in fifty, which gives a high velocity and are nearly self-cleansing. The sludge is discharged onto the center of the bed through an 18-inch opening controlled by stop boards in the side of the trough. The sludge falls onto a concrete splash plate. A depressed channel extends transversely to the sludge troughs between the first and second and the third and fourth beds of each tier. This channel is four feet below the top of the bed and nine feet deep and nine feet wide. In this channel is laid a narrow-gauge track for the sludge cars and on the walls are tracks for a gantry crane.

The beds are level and consist of 2 inches of fine sand, 3 inches of coarse sand, 8 inches of gravel and 6 inches of broken stone. They are under-drained by 3-inch farm tile laid with open joints on 8-foot centers. These tile discharge into an open drain under the track channels.

The Imhoff tanks have two rings of perforated pipe in each hopper and the sludge is agitated each week. The sludge pipes are also blown out and left filled with clear water after each drawing. No cones are found in the sludge surface and no plugging of the pipes has been experienced.

Drawings are made during the season as often as the removal of the dried sludge permits. Nine inches of wet sludge are drawn on a bed. The drawing season is reasonably constant as shown by the following table:

Year	First Drawing	Last Drawing	Period in Days
1919	April 29th	December 10th	225
1920	May 7th	December 21st	228
1918	April 15th	November 15th	214
1921	March 24th		

*Paper before the American Society for Municipal Improvements.

†Engineer in charge of sewage disposal, Rochester, N. Y.

While the season is nearly the same each year the number of drawings varies according to the weather. In 1920, each bed received nine fillings, an average of one every twenty-five days. In 1921, an extreme drought permitted seven drawings between March 24 and June 23, an average of one every 13 days with the longest drying period 22 days and the shortest 10 days. Up to August 10, four additional drawings have been made, which gives a season's average to date of 12.6 days per bed.

To remove the dried sludge, two trains of six 1½-yard Koppel cars are used. The trains are run in the depressed channel under the gantry crane, which lifts the car bodies from the trucks and sets them on the bed and replaces filled bodies on the trucks. In loading cars, stone forks are used and the sludge lifted in cakes approximately 12 inches square. A few extra car bodies set on the beds permit the moving of trains without delaying the labor force. The trains are hauled by storage battery locomotives and the crane is electrically operated, as power is developed at this plant from the effluent.

The usual force consists of one foreman, one hoist man, two locomotive runners and eleven laborers. Eight men do the loading, one is on each train to dump the cars and one is at the dump to keep the track clear. This crew will remove on an average two hundred cubic yards of loose dry sludge in eight hours. With labor at 50 and 55 cents and neglecting power costs, this sludge is delivered to the spoil bank at 33 cents per cubic yard.

During much of the season the sludge is sold to farmers as removed from the beds. The cars are run to the tipple and dumped directly into the wagons or trucks. As the tipple is located further from the beds the additional haul and delays in dumping increase the cost of removal 10 per cent.

The sludge when drawn contains from 79 to 86 per cent of moisture. It is more dense in the first drawings each season and is thinner as the season progresses. At the time of removal the moisture is reduced to from 50 to 60 per cent. A rain on the beds after the cracking has occurred packs the sludge so that it is difficult to reduce the moisture below 60 per cent in any reasonable time. The shrinkage in drying is normally a little more than half of the wet volume. Analysis of a dry sample yields 2.2 per cent nitrogen and 56.3 per cent mineral matter.

Due to the depth of the tanks, the entrained air bubbles expand greatly when drawn onto the bed and make the dried sludge a light, porous cake.

The quantity of sludge varies, but the average for three years has been 1.51 cubic yards of wet sludge per million gallons. In a large plant the disposition of the dry sludge becomes a problem. Realizing this, the plant at Rochester started in 1918 to develop a demand for it as a fertilizer. During that time it was given to any farmer who would load and draw it away. The plant is located in a fruit and truck garden section having a sandy loam soil. Reports of the use of this fertilizer were not enthusiastic. This was in part due to a belief that enthusiastic reports would increase the price. In 1919 a charge of 50 cents a load was made, the buyer loading from the dump, and more was drawn away than in the previous year with no charge. A proposal came from the farmers that with a more convenient method of loading they would pay a higher price. The tipple was erected and the price put at 75 cents per car, the car holding nearly two cubic yards. When sludge is not being removed, the dump is still open at 50 cents per yard. During 1920 the income from this source was $1,015. To July 1 of this year it has been $650. The income is small but the disposal of continually increasing quantities is preventing an accumulation on the grounds of the plant.

It is being hauled for distances up to five miles. In peach, cherry and pear orchards it is used as a top dressing spread around the trees. On the truck farms it is spread with fifty yards to the acre and plowed under. The truck men use it under corn, tomatoes, celery, cabbages and melons. It is still impossible to obtain reports favorable to sludge, but the same farmers are drawing it after four years of trial and using more than ever before.

Cotton Pavements

A new material in road work has been employed on the highways of the Imperial valley, California. The sand in this section of the country makes it very difficult for automobiles to travel over highways which have not been surfaced with some other material. When cotton prices were down to a point where it hardly paid to haul it to market, some growers spread the raw cotton over the highways. The cotton pods seemed to sink down into the sand just far enough to hold the shifting sand in place and prevent the wheels from sinking in too deep. It is by no means a substitute for other paving materials but seems to serve its purpose of turning an impossible road into one that can at least be used by ordinary vehicles.

Record Road Construction

An unprecedented amount of road construction is being accomplished this season in Iowa, where 60 principal contractors with approximately 200 dirt moving outfits are handling a total of about 25,000,000,000 cubic yards of earth on the state primary road system. The total number of contractors engaged in the road construction is not less than 200, the majority of whom are sub-contractors for 50 or 60 larger firms who hold the contract with the counties. About 50 of the larger contracts provide for handling 100,000 yards or more of earth, much of which is moved by caterpillar tractors, hauling blade grader machines.

Operations were commenced unusually early by grading operations in March, many of the paving outfits being at work before the end of April and at the present time work is being executed at the rate of $2,000,000 worth per month.

During the month of July the average daily progress was 6 miles of permanent grading, 2 miles of gravel surfacing, and 1½ miles of paving on the primary road system, and it is expected that all of the time limit work will be completed this season. The general average price for grading has been 36.4 cents per yard with a minimum of 22 cents. Concrete pavement prices have been as low as $2.88 per square yard for 1½ mile section and bituminous filled brick $4.48 per square yard, gravel hauling and spreading averaged 61.4 cents per yard for distances not over 1 mile and 16.4 cents for each additional half mile. More than 207 miles of tile drains have been contracted for at an average price of 7.1 cents for 6-inch tile plus 8.5 cents for the labor.

Many of the contracts are large, some of them being for as much as 18 miles of concrete pavement and 22.8 miles of grading. Another grading contract 11.35 miles long involves moving 252,000 cubic yards of earth.

Inverted Siphons for Sewers*

Cleaning by hand. Stoppages very infrequent. Duplicate pipes. Ventilation. Essential principles. Massachusetts statistics.

Method (f) is used in the West Bartlett street siphon in Brockton.

Where inverted siphons are to be cleaned by hand, this generally implies the use of jointed rods with suitable scrapers or other tools attached at the forward end. The pipe to be cleaned must be emptied of water by either draining at a blow-off or pumping at a manhole, and during the cleaning operation the flow of the sewage must be diverted through another pipe, if there is a duplicate, or held back in the approaching sewer, or discharged through an overflow into a stream. Such overflows serve the additional purpose of providing for excess sewage flow during storms and preventing the sewage backing too far up the approaching sewer.

Access to siphons for hand cleaning is obtained through the manholes at their ends. If the siphon is built with inclines at the ends joined by a flat section, it is advantageous to have additional manholes at the breaks in gradient. In such cases either the manholes and their covers must be made to resist the pressure in the siphon or else the manholes must be carried up above the hydraulic gradient. The latter is objectionable because of the great probability that grease and other scum will rise into such manholes and finally form a solid plug, as was found to occur in the Dorchester bay siphon and in a 36-inch siphon at Wilmington, Del.

*Continued from page 341.

STOPPAGES IN SIPHONS

In spite of the reasons for anticipating deposits and stoppages of inverted siphons, stoppages are comparatively infrequent, even where the siphons are never cleaned. Experiences in several cities lead to the supposition that in many cases deposits do occur, but as such deposits reduce the free area of the siphon they thus cause an increase in velocity of flow, and finally a point is reached where such velocity is sufficient to prevent further deposits, and this more or less variable condition of equilibrium is thus automatically maintained and prevents complete stoppage of the siphon.

In at least two or three instances in the case of combined or intercepting sewers, further automatic action was found to be due to occasional considerable increases in volume of flow, due to heavy rainfalls which so increased the quantity and consequent velocity as to automatically flush out a part or all of the deposited matter at intervals.

In the case of a siphon at Wilmington, Del., A. L. Shaw made a careful investigation of conditions and computed that the probable velocity of flow through the net opening in the siphon, which was contracted by deposits, ranged from about 2.7 to 4.0 feet per second, or about the velocity generally accepted as necessary to prevent deposits and secure a certain scouring.

As stated, stoppages have been remarkably infrequent. Of the 145 siphons reported in Massachusetts in 110 cities, 88 were reported never to have stopped and only 14 stoppages were reported, the remaining not answering this question. When a stoppage does occur, however, it may be a very serious matter. Perhaps the most serious that came to the knowledge of the committee was one in Brooklyn in 1916. This siphon consisted of two 48-inch pipes for storm water and one 18-inch for dry weather flow. When this became stopped the sewage overflowed into a cut opened for subway construction, backed up into the subway and threatened to stop the operation of the trains by its depth. Rodding was practically impossible and flushing by hose was tried unsuccessfully. Finally a contractor was engaged to install four large centrifugal pumps at different manholes which pumped the sewage into the gutter, in which it flowed to another sewer. When the sewage was lowered, however, these pumps became clogged with heavy sewage and a sand pump was put into operation to remove the accumulated grit. This point was not reached until four days after the stoppage took place. It was then found that the entrance to all three pipes was completely obstructed with a mound of debris consisting principally of mattresses, a load of lumber of various sizes, a long-handled shovel, a pieces of bluestone curbing, a wooden barrel, several iron pails, bricks, pieces of concrete, tin cans, umbrella frames and large amounts of rags and other small rubbish. As soon as these were removed the sewage started to flow through the siphon, which required little additional cleaning.

About three-fourths of the inverted siphons in Massachusetts have but a single pressure pipe,

but in a great many cases two, three and sometimes four parallel pipes are employed. At least two pipes would seem desirable. In the separate system additional pipes accommodate the increased volume of sewage that comes with lapse of time, without increasing the working head. Also, arrangement is easily made so that one pipe may be isolated temporarily for cleaning while the flow is carried by the other pipe or pipes. In the combined system, because of the great variations in flow, the use of two or more pipes is especially advantageous, one being reserved for dry-weather flow, while storm flow spills over side walls or wiers in the entrance chambers at the head of the inverted siphon, into the special storm pipes. It is generally desirable to separate the entrances to the several siphon pipes by walls or dams and use a similar construction at the downstream end of the siphon so that the dry weather sewage after passing through one pipe of the siphon cannot back into the other pipes in which there is no dry-weather flow, and stand there to cause deposits and putrefaction.

While the inverted siphon is always full of water after once being put into service, unless it is drained intentionally, before actual use and when being cleaned it will generally be empty and therefore buoyant if below the bed of a river. This should be taken into consideration and provision made if necessary to prevent its floating to the surface of any body of water under which it passes.

VENTILATION

In this country no attention seems to have been paid to the ventilation of inverted siphons. If the hypothesis made in the previous paragraph, that siphons retain deposits until the bore has contracted a sufficient amount to enforce a velocity of 2½ to 4 feet per second, is correct, then there is almost sure to be putrefaction taking place in such inverted siphons. Probably most or all of the gases of putrefaction are absorbed by the sewage flowing through and may or may not be released when the pressure is relieved when the sewage emerges from the siphon. Instances of such release of gases have been found in this country, one of the best known being that of the Los Angeles outfall sewer built in 1895, where two siphons of wood stave pipe, each about 3.4 miles long, are joined by a section of brick-lined tunnel. A few years later a strong odor was noticed at the outlet from the upper siphon and at a 12-foot vertical drop in the sewer about a mile and a half below, and at these points the cement in the masonry was found to be disintegrating rapidly. A similar experience is reported in connection with the inverted siphon of the metropolitan sewerage works. In one manhole after having been closed for a year and a half the mortar in the brick work was found to be soft like putty.

ESSENTIAL PRINCIPLES

The committee concluded its report by quoting the following essential principles as set forth by S. B. Bleich in a paper written in 1917:

"1. Complete and effective separation of the house sewage and industrial waste from the storm run-off at all times.

2. Simplicity of construction.

3. As slight and easy changes in direction of flow as are practicable at the entrance and exit legs.

4. Easy curves where necessary.

5. Uniform section throughout entire length of siphon pipes.

6. Elimination of all features tending to obstruct flow.

7. Omission of all moving parts and mechanical devices.

8. Provision for easy access to all pipes without impairing any of the essential features.

9. Entrance and discharge openings to have sufficient area within the available height not to cause any back-water; and change of section or direction not to be too abrupt."

MASSACHUSETTS STATISTICS

Accompanying the general report above abstracted, the committee submitted six appendices, giving respectively a tabulation of the answers to the questionnaire, analysis of these data, detailed descriptions of certain inverted siphons in Massachusetts, data relating to certain inverted siphons outside of Massachusetts, notes relating to siphons outside of Massachusetts and a bibliography.

The questionnaire submitted to Massachusetts cities was sent to 110 cities having sewerage systems and 45 returned data regarding 145 inverted siphons in their systems, about ⅔ of which were on domestic sewers, ¼ on combined or storm water sewers and 8 on the metropolitan main lines.

Cast iron was used for about ⅔ of the cases, about 20 siphons were of vitrified sewer pipe, about a dozen were of concrete, some plain and some reinforced, and about a dozen, under light pressure, were of brick.

The smallest pipe reported was 4 inches and the largest 78 inches. The majority of the pipes seemed to be 6, 8 or 10 inches. Blow-offs for emptying the siphon were reported in 18 cases. In 16 siphons sumps are reported at the upper end, at the lower end in 32 cases, at both ends in 17 cases and 58 had sumps at neither end

In the matter of maintenance, the principal reliance is placed on flushing. Of 83 siphons concerning which this information is given, 54 use flushing, supplemented by hand cleaning in 32, while in 11 cases hand cleaning is the only method employed. In about ⅓ of the cases where flushing is used, it is applied once a year in about the same number of cities at intervals of from 2 to 6 months, in about half as many at intervals of from 1 to 4 weeks, while in two Concord siphons the sewage is stored and automatically discharged at intervals of between 2 and 3 hours.

None of the siphons reported upon in Massachusetts has ever had to be dug up on account of stoppage, but 14 cases of serious clogging were reported in 10 different cities.

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Pass a Federal Aid Road Bill

Public Delay by Congress in passing a Federal aid road bill "is working infinite mischief throughout the country, actually threatening to make the unemployment crisis worse instead of relieving it." These are the words of the sub-committee on Public Roads of the President's Conference on Unemployment. In Minnesota, for instance, if a new Federal appropriation is not made at once more than twenty thousand men and hundreds of teams will be thrown out of work, and in Pennsylvania a number nearly as great.

That is the direct result. In addition, stopping road building means shutting down of quarries, cutting of the market for cement and other materials, the working of gravel pits, the manufacturing of road building machinery, and other industries related more or less directly to road building.

On the other hand, the immediate passing of a bill making a liberal appropriation for road work would enable states all over the country to furnish work throughout the winter to thousands who will otherwise suffer and possibly become, with their families, public charges, because of unemployment.

The Cities' Responsibility

But the cities and states also can do much to solve the problem, and to the extent that they can do so the responsibility is theirs as well. Probably no city has not some public work in view that is either fully planned or at least definitely accepted as desirable, if not absolutely necessary. Now is the time to put it under way. When private enterprises are holding back is the time for public ones to expand. And this for several reasons. Perhaps the most important is that it furnishes employment when it is scarce rather than when it is abundant. Also, it can justifiably get it at lower rates instead of competing with private enterprises and unnecessarily boosting wages, as is the effect of public works done in boom times. Moreover, many of those who support themselves by giving their services to the public in exchange for wages, would, if unemployed, be supported by the same public through charity without giving any service in return; and the city would lose rather than gain by refraining for spending money for public works.

As for the money, it would be raised by bonds to be paid for during several years to come, when times will be better, we all are certain.

As an example of what many cities are doing, Joseph H. Gainer, mayor of Providence, writes us:

The city council at my suggestion created a Joint Special Commitee with power to consult with the heads of the various departments to ascertain what public work under the city auspices might be begun at the present time. This committee is now making plans which it will announce shorty.

In addition to this, I have called together leading manufacturers, business men and labor leaders of Providence and had them form themselves into a Citizens Committee for the relieving of unemployment. This Committee will attempt to do two things. First, it will open a registry bureau where an attempt will be made to get an accurate knowledge of the unemployed in Providence Secondly, it will endeavor to arouse a public sentiment which will furnish work to which the unemployed may be directed. I expect the City Council Committee and the Citizens Committe will work in harmony.

Prior to the creation of either committee, we had started two matters of importance. Recently we let the contract for the main dam on our new Water Works project, the matter involving several million dollars. A provision in this contract required that, other things being equal, local labor and local supplies should be obtained by the contractor. A new road contract on the water development project was let with even more rigid restrictions as to local labor, the contractor agreeing to employ all but seventeen of his force of one hundred men from domiciled inhabitants of the City of Providence. Two weeks ago we let the contract for a New High School Here again the contractor agreed to employ local labor and buy his supplies locally wherever it was possible to do so.

Public Works as an Equalizing Reservoir

But it is to be hoped that cities and states will not allow the matter to drop with the passing of this emergency. For the reasons already suggested and others, certain public works can to advantage be speeded up or held back as labor conditions may make desirable. Such works of great magnitude, extending over years in their construction and through generations in their enjoyment by the public, can be regulated in this way as private works could not be.

To provide for such depressions as the present, work of this kind should be planned by each city to extend over a series of years and act as a powerful stabilizing influence, to be shut down entirely when private enterprise is at a peak and pushed to its fullest extent when there is a depression in general business. Pennsylvania and California have already legislated machinery for this purpose. Surely other states and cities can exercise the same foresight.

Recent Developments in Water Works Matters

The report of the Committee on Water Works and Water Supply of the American Society for Municipal Improvements, of which Nicholas S. Hill, of New York, is chairman, was an excellent survey of the present status of water supply practice and of recent progress along the several most important lines of development. The general features dealt with included personnel, ownership, economic development, uniform accounting, standard materials, pumping machinery, rainfall and run-off records, works for the collection and distribution of water, standards for water quality, water softening, water supply and disease, water purification, and electrolysis. Each of these subjects was discussed at greater or less length, and the length of the report unfortunately renders it impracticable to reprint it entire in PUBLIC WORKS. We have endeavored, however, to present in the following paragraphs quotations and abstracts which give a general idea of the points brought out by the committee.

PERSONNEL

Under the head of personnel, particular attention was called to the importance of securing the best men available.

"The health and safety of every resident depends upon a proper water supply and the time has come when the public, which owns the great majority of the water works in this country, and municipal officials in particular, should be brought to a realization of the responsibility which they intrust to water works officials and to recognize the folly of denying those officials the compensation and other advantages of men performing like work for private industries.

"It is difficult to estimate the total sum of money invested in water supplies in the United States because statistics are not available from which such information can be gleaned. It is a fact, though, that except for playgrounds and parks, the money invested in no other branch of municipal activity even approaches in amount that invested in water works plants. It is absolutely essential, therefore, that the men charged with the responsibility of the administration of water departments should be qualified for the work on economic grounds alone. It is penny wise and pound foolish to select mediocre water works officials simply to save a small amount in the salary account when, on the contrary, only men trained and experienced in the specific work of water supply management should be engaged.

"While progress in the administration of water works has been made, there is a marked lack of expert supervision due to the inadequate salaries paid to municipal employees of the water works departments. Specifically, the results obtainable through expert supervision of a water works are:

1. Better service.
2. Reduction in cost of operation.
3. Proper anticipation of future requirements.
4. Improved design.

"Better service means an ample quantity of pure and clear water for domestic and industrial purposes and safeguarding the community against disastrous fires. Decreased cost of operation means supervision of all details of operation in such a manner that effective service will be rendered at minimum expense. Anticipation of future requirements means that all necessary increases in the supply and equipment will be foreseen so that they may be provided before the community is reminded of its needs by destructive fires, inadequate equipment, or disas-trous epidemics due to the pollution of the water. Improved design will result from expert knowledge of operating conditions."

Under the head of ownership it was stated that four-fifths of the public water supplies are municipally owned and the tendency toward municipal ownership is growing in spite of the greater cost of municipally than of privately administered plants, the public being willing to pay the price for the added security it feels under municipal ownership.

ECONOMIC DEVELOPMENT

Under the head of economic development the report states that municipal plants as a rule are notoriously inefficient and operated on absolutely unsound economic principles. Municipal water works should be operated on the same economic principles as those on which a private utility would operate and the former should make the same reasonable charges for water as would the latter. Every charge that is made for water should be based on the fundamental principle that the revenue must equal the expenses. Some of the

revenue, however, should come from taxation and some from water rates, and the distribution of these should be the same whether the plant is municipally or privately owned.

At present in some municipal plants the water rates are so high as to cover all operating expenses, pay interest and sinking fund charges and even turn in excess earnings to the city treasury for general purposes. On the other hand, in some municipalities the water rates are insufficient to pay operating expenses alone and these are made up from the general tax levy; while in still other cases the interest on the water works bonds is paid from the tax levy and revenue from water rentals is used for operating and maintaining expenses.

It is possible to determine what proportion of the expenses of the department should in equity be derived from water rates and what from the public treasury, and unless such relation is determined and acted upon in the fixing of rates, the officials operating the department will not feel a proper sense of responsibility for making the utility an independent, self-sustaining institution.

UNIFORM ACCOUNTING

Attention was called to the fact that it is almost impossible today to compare the results of the operation of water works plants in different places. Public utility commissions in various states have prescribed uniform accounting systems, but few of them have power to enforce them on municipal plants. The general use of a uniform system, permitting comparative studies of operating costs and expenses, is prerequisite to the establishment of equitable and just rates. The committee believes that the cost of municipal operation in general could be greatly reduced if the accounts enabled the heads of municipal governments to properly segregate costs and by analytical studies see whether expenditures were properly or improperly made.

"Operating reports of water works have been pretty generally standardized and in this respect present conditions are an improvement over those which existed in the past."

PUMPING MACHINERY

A brief history is given of the development of pumping machinery from the first modern pumping engine brought out by Henry R. Worthington about 1840, through the development of the duplex, direct-acting pumps, which have reached an efficiency of 170 to 180 million foot pounds.

"All of the pumps up to fifteen or twenty years ago installed in water works plants were of the reciprocating type, either direct acting or crank and flywheel, or either vertical or horizontal pumps, as the case may be. The term 'reciprocating pump' covers all pumps in which the water is displaced by a plunger, piston, or bucket, working back and forth in a cylinder. The past fifteen or twenty years marks the development of the centrifugal pump, although in 1680 the first centrifugal pump was built, and 1818 was the year when the first crude pump of this type, called the Massachusetts pump, was built in this country. It is probable that the centrifugal pump did not come into general use because of the fact that it is a relatively high speed machine and there was no motive power well suited to it, but with the introduction of the steam turbine and electric motor, conditions have changed. These high speed machines stimulated the development of the centrifugal pump and we now find an ever increasing demand for this type of machinery.

"Probably another reason for the delay in demand was due to the low efficiencies of the earlier types of centrifugal pumps, but at the present time turbine-driven centrifugal pumps of large capacity have been installed in water works plants which have produced duties of from 135 to 165 million foot pounds per 1,000 pounds of steam as compared with 170 to 180 million for the best types of reciprocating engines.

"When the low first-cost of the turbine-driven centrifugal pump is taken into consideration, it makes a very attractive proposition for large water works. In small isolated water works the electrically driven centrifugal pump offers many inducements, and there are to be found now many installations of centrifugal pumps which are driven by producer gas engines, oil engines of the Diesel type, and gasoline engines. The tendency towards centrifugal pumping machinery is notable and marks a step in the evolution of water works design."

RAINFALL AND RUN-OFF RECORDS

Stressing the importance in all water works designing of a knowledge of precipitation and run-off, the committee expresses its belief that: "A knowledge of the amount of run-off in various localities and in various watersheds is absolutely essential to the proper design of dams and reservoirs. One of the great difficulties which the water works engineer had to contend with in the past was the absence or paucity of suitable rainfall and run-off data. Great strides have been made in maintaining gauging stations for the purpose of recording the run-off of streams in various parts of the country. These have been of invaluable assistance in the proper and secure design of water works. Few people recognize the value of maintaining rainfall and run-off records. This committee begs to call its importance to the attention of the municipal officials and to request that they encourage the maintenance of such records in the states in which they live, and to the water works officials here present a request is made that they maintain such records on the watersheds under their jurisdiction and control."

QUALITY AND PURIFICATION OF WATER

"In certain sections, the northeast particularly, waters having colors of 25 or more are still used without complaint. These colors would not be tolerated in western cities supplied with lake or filtered water. Even in New England, public opinion is fast getting to a position to demand water of an average color of 10 parts per million or less with a maximum of 15. Particular objection is made to colored surface waters containing odoriferous organisms, and turbidity, whether due to heavy microscopic growths, to clay, or to iron rust, is also objectionable."

Softening of water is important from a commercial much more than from a health standpoint, hard waters being objectionable for domestic and laundry use, for boiler use and for many industrial processes. It is probable, therefore, that increasing competition between cities for attracting industries to them and the rising standards for domestic water supplies will lead to a substantial growth in water softening. The progressive city with an ample supply of soft water will grow while others will stand still. In addition to the lime-soda process in use for 70 years, artificial zeolites, of which "permutit" and "delcalco" are trade examples, have had wide-spread use in the industries and are beginning to enter the municipal field.

There is a consensus of opinion that storage is perhaps the most reliable single method of purification of water, although not free from the danger of wilful or accidental contamination.

The use of the "hydraulic jump" to mix chemicals with water, introduced by J. W. Ellms in the Milwaukee experiments, seems to be a simple and effective substitute for the older methods of baffled channels, agitators, wiers and other mixing devices.

"Where filtration and softening are combined, difficulties resulting from the so-called balling up of the filter sand, due to the accretion of lime deposits on the sand grains in the filter beds, are being overcome by several methods which have been developed recently."

In the matter of treating colored waters and those of low alkalinity to produce an effluent free from color, turbidity and colloidal aluminum hydrate, the committee calls attention to the use of hydrogen ion concentration as a measure of the reaction of the water in adjusting treatment to condition.

The existence of a filter plant gives a feeling of security to a community, but such a plant operated without proper supervision may be but a blind to camouflage a really critical situation. Every filter plant should receive sufficient supervision by expert chemists and bacteriologists to insure its efficient and safe operation. Many cities are realizing this and most of the state health departments. The state of New Jersey is believed to be the pioneer in requiring all filter plant operators to be licensed, the laws of that state requiring that every purification plant must have a licensed operator, the license being obtained from the State Department of Health after an examination calculated to prove him to be capable of performing the duties attached to such position. Licensing of operators and making daily routine analyses, however, will not insure the desired end unless the water works superintendent uses such analyses, applying them intelligently to the operation of the plant.

ELECTROLYSIS

The committee refers to the American Committee on Electrolysis, consisting of representatives of the electric railway, electric light, telephone, gas and water interests, which has already made one report on the subject of electrolysis and is expected to make a second within a short time. Active committees now exist in Chicago, Kansas City, Omaha, St. Paul, New Haven, Milwaukee and Syracuse, composed of technical representatives of the several utilities of the city concerned in the matter, to investigate the local electrolysis situation and determine by agreement the course of procedure to be followed. The railroad commission of Wisconsin has authorized an electrolysis committee in that state to act as a clearing house of information and provide for joint electrolysis surveys and the installation of unified methods of mitigation.

Granite Block Pavement*

Present methods of mixing and applying filler and improvement possible. Sand and grout filler. Necessity of ramming.

By Clarence D. Pollock†

The standard granite block pavement as now laid is placed on a cement concrete foundation, usually six inches in thickness, with a cushion of one inch of sand or a mixture of cement and sand in the proportion of one part of cement to four parts of sand by volume. The standard block 8 to 12 inches in length, 3½ to 4½ inches in width and 4¾ to 5¼ inches in depth is generally used. Where traffic conditions are such that the street cannot be blocked off for a sufficient time to permit the grout to set properly, an asphalt mastic filler is quite generally used.

BITUMINOUS FILLER

This asphalt mastic filler is of rather recent origin, but has been very satisfactory when properly mixed and placed. In place of the asphalt, a coal tar pitch is sometimes used, and also a mixture of coal tar pitch and asphalt. The coal tar pitch and sand alone has not given very good results, but a mixture of five parts of coal tar pitch with one part of asphalt has given much better results, as it is less susceptible to temperature changes than the coal tar pitch alone.

The usual specification for the bituminous filler calls for a mixture of the paving cement and hot, dry sand in the proportion not to exceed one part of sand to one part of the paving cement by volume, or as much sand up to this proportion as the paving cement will carry. The sand is usually specified as all to pass the 10 mesh sieve or all to pass the 10 mesh and 80 per cent the 20 mesh sieve.

The common method of mixing this bituminous mastic is to draw the hot asphalt or pitch from the heating kettle into a steel push cart or a wheel barrow and then shovel in hot sand, counting the shovelfuls and then stir with a perforated hoe or rake. In some places a small gasoline mixer is used. These methods are crude and it requires great care in order to secure good results. If the sand is coarse, or damp, or if too

*Paper before the Paving Conference held in Philadelphia October 20 and 21.

†Consulting engineer of New York City.

much is added, the mixture will not run into the joints and completely fill them. Coarse sand will settle out and lodge in the closer joints and dam up the mastic. Too much sand will make the mixture so stiff that it will not flow into the joints. The usual practice is to dump the hot mixture from the push-cart or wheelbarrow upon the surface of the pavement and push it into the joints with a hoe or a squeegee. This operation should be carried out rapidly and care used not to push the mastic out so thin that it will chill before it can penetrate the joints fully.

The asphalt should be homogeneous, its melting point between 115 and 130 degrees Fahrenheit, not less than 98½ per cent soluble in carbon tetrachloride, its penetration at 77 degrees Fahrenheit not less than 60 nor more than 100, and at 100 degrees Fahrenheit its penetration should not be more than 3½ times that at 77 degrees. Its ductility at 77 degrees Fahrenheit should not be less than 40 centimeters at the penetration called for; it should not lose more than 3 per cent by volatilization when maintained at a temperature of 325 degrees Fahrenheit for five hours, and the penetration of the residue after such heating should not be less than one-half of the original penetration.

After the hot paving cement and sand mixture has been flushed into the joints thoroughly, a small amount of clean sand should be spread over the surface.

The sand used in the mastic should be a uniform fine-grained sand, as this will remain in suspension better and will not clog and dam up the closer joints and thus prevent the flowing of the filler. As was mentioned above, the present mixing methods are crude. The gasoline mixer is an improvement on the hand mixing, but there is a good opportunity to devise more accurate methods of measuring the materials in order that the amount of sand used shall be uniform. It is also desirable that tests be made to determine more accurately the proper amount of sand to use. This should be as much as possible and still permit the mixture to flow readily into the joints. From observation this would seem to be in the neighborhood of about 40 per cent, but we hope to see some test sections tried, varying the amount of sand from say 30 to 50 per cent, using a good fine sand such as an asphalt sand.

This filler in its crude state has proved so satisfactory that it seems well worth while trying to eliminate as much of the guesswork as possible and make it more "fool proof."

CEMENT GROUT FILLER

In connection with the cement grout filler, the greatest improvement has been the more general use of a machine mixer, such as a small batch concrete mixer with a spout or trough, which delivers the grout directly onto the pavement. This gives much more uniform results than the old hand method of mixing the grout. Here also it is important to use a uniform fine grained sand in order that it may be held in suspension until delivered in the joints of the pavement.

To obtain good results with a cement grout filler even greater care and attention to details is required than with the bituminous mastic. Any carelessness, such as permitting sand to get part way up in some of the joints so that the grout does not penetrate to the bottom, will cause bad defects in the pavement, as the thrust from expansion will have to be carried by the upper part of the joint and this will crush the heads of the blocks.

RAMMING AND CUSHION

Since the general use of the shallow cushion between the blocks and the foundation, there has been a tendency to slight the ramming. This is wrong. It is just as important as ever to ram the blocks thoroughly and then back-ram them after raising any low blocks. If this is not done the traffic will later pound down the shallower and more poorly bedded blocks and a poor surface will be the result.

With a cement grout filler and heavy traffic an improvement has been the use of a dry cement mortar cushion of one part of cement to four parts of sand. This gives a very solid and firm pavement, as the mortar cushion has an opportunity to set while the grout is getting its set. This cushion has been used in some places with a bituminous filler, but here the traffic is permitted to pass over the pavement before the cushion can obtain much of a set and it would seem to be a waste of money to use the cement in the cushion. It will set in places where traffic does not pass over it and the set will be broken where it is subjected to traffic.

IMPROVING THE FILLER

The present standard block specification with proper inspection produces about as good a block as can be made without making the cost prohibitive. With good inspection these can be paved with close joints and with thorough ramming a good surface can be obtained and maintained; but, as has been suggested previously, while there has been considerable improvement in the joint filler, there is still opportunity for much improvement.

It is urged that the engineers of municipalities having charge of granite paving work try out various mixtures of sand and asphalt and thus find out in actual service what is the best mixture within reasonable working limits. In such tests care should be taken to use uniform fine grained sand which is thoroughly dry and hot. This mastic should be agitated by mechanical means until it is flushed into the joints. The crude method of heating the sand by placing it over iron pipes containing wood fires, as is still frequently done, should be avoided. Fine hot asphalt sand, when it can be obtained, gives the best results. A practical method of measuring the sand and asphalt should be provided, as the method that is now quite general of using a shovel to measure the sand is crude and does not give uniform results. Proper attention to these details should produce a filler that will make the modern granite block pavement about as near an ideal pavement for heavy traffic as it is possible to produce at a reasonable cost.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How Should Aggregate for Road Concreting Be Stored and Delivered?

Many good systems have been developed which should be considered and selections, modifications or changes made to suit local conditions and requirements. Operations and equipment should be completely scheduled in advance.

The construction of an 18-foot concrete pavement or foundations for an asphalt or block pavement is likely to require about ½ yard of stone and approximately one-half as much sand per linear foot, amounting to a total of between 5,000 and 6,000 cubic yards of aggregate per mile of road, exclusive of any that may be required for culverts, bridges or other structures.

The problem of insuring a sufficient supply delivered so as to be certain to be always available when required and not to overload storage facilities if they are limited, stored advantageously for loading and unloading and delivered most easily, quickly and reliably, and all done so as to secure the greatest ultimate continuity and rapidity of work and economy of construction and with a minimum of waste or delay is a very important problem, on the correct solution of which depends the success of the job and often the realization of any profit to the contractor.

Within the last few years many different methods have been employed for storing, handling and distributing the aggregate, measuring it and delivering it to the concrete mixer and a considerable quantity of special equipment has been put on the market for this purpose, adapted to various systems that have been developed by manufacturers and are strongly urged by them to promote the sale of their products.

Many, if not all, of these systems and appliances possess considerable merit, but none of them are equally desirable for all conditions. It is, therefore, necessary on any job of importance to plan the working methods and operations and the equipment installed in accordance with the local conditions and requirements and to conform to certain general factors that are more or less vital to any concrete paving job.

Some of these factors will be here briefly considered, and it is assumed that the work is comparable in design and requirements with the trunk line work of the various state highway departments for whom a very large proportion of concrete road construction is done, and that it is to be executed chiefly in suburban districts where concreting operations are proscribed by climatic conditions during the winter months, as is the case, except in the southern portion, in the United States.

Among the principal factors governing the storage, handling and distribution of the aggregate are the size of the job and the rapidity with which it must be constructed; the equipment already possessed by the contractor; the sources of supply for the sand and stone and the rate and regularity with which it can be supplied from the source to the contractor; the length of haul and character of roads over which the aggregate is hauled; traffic conditions; width of road; topography; climatic conditions; availability of new equipment; and considerations of probable future construction contracts.

If the job is very large or if it must be done with great rapidity or there is a special scarcity of labor a larger amount of equipment is justifiable or is even necessary than for small jobs that may be occasionally executed slowly with an abundance of cheap labor. Generally speaking, however, any equipment is justified which will save enough labor cost to pay for itself on the given job. In which case the question arises, not as to provision of equipment, but as to the choice between different kinds of equipment. In any event the equipment purchased should be first class and standard. Whatever methods and plans are adopted it must be remembered that unless sufficient tools and apparatus are provided to insure the continuous employment of the men, heavy losses will be incurred through the payroll and disorganization of morale will certainly follow; that mechanical equipment works continuously day and night and never goes on strike; and that the saving of a few men's wages daily soon pays for the expensive equipment and that usually has a high salvage value after the work in hand is completed. The method of handling and distribution of aggregate should therefore be planned with a view to utilizing to best advantage the equipment already possessed by the contractor and to supplement it if necessary by additional equipment especially suited to the existing conditions.

If a contractor is abundantly supplied with a certain class of equipment which makes it possible to do the work at a moderate unit cost it may be better to use this equipment than to sesure new equipment at a high price that will execute the work at a smaller unit cost. If such a question arises a careful estimate should be made for the total cost of doing the work by each method with proper allowance for greater rapidity and the elimination of overhead charges and risks due to delay, and it may be found that the job will have to be a very large one to justify securing the reduced unit cost with heavy initial outlay.

If the aggregate is imported from a commercial dealer it may be necessarily delivered at a single point, either by rail or water, where it will pay to establish unloading, storage and loading facilities commensurate with the size of the job, and in any case designed to secure the greatest convenience and expedition of operations and insure a continuous supply with a margin of excess above current requirements at a minimum total cost for the whole work. In other cases it may be possible to have the materials delivered at several points or even distributed along the work in case the latter is closely paralleled by any commercial delivery system whether it be by water, by rail or by highway. It may also be possible to secure the supplies from two or more sources that can advantageously deliver to different points or if it is delivered by the seller with automobile trucks, arrangements may be made with him to deliver it exactly as required for the progress of the work by daily notice of the amount and at the points desired, thus entirely avoiding rehandling or storage.

If the aggregate or portions of it are dug or quarried by the contractor himself he may either arrange to get out a large quantity in the winter season or in idle times and store it for use as required or to produce it in quantities slightly in excess of the demand and deliver directly to the paving machine as required.

The method of distribution depends considerably on the length of haul and the character of the road over which the haul is made. Very short hauls on level roads where the principal time consumed is in loading and unloading, may be advantageously made with teams. Longer hauls with motor trucks, or trucks and trailers, or trailers drawn by tractors, especially if the roads are poor or the grades are heavy. For moderate grades and long hauls, such, for instance, as to remote parts of a very long section of road construction, industrial tracks and dump cars or flat cars with batch boxes, drawn by gasoline or dinky locomotives are likely to be economical and desirable.

It is also necessary to consider the existing traffic conditions provided traffic is maintained over the road itself if the work is the reconstruction of an old road, and arrangements must be made so that traffic will not seriously interfere with the delivery of aggregate or that the delivery of aggregate will not greatly impede the traffic. In either case, plans should be perfected enabling both traffic and hauling to utilize as much as possible the undisturbed surface of the old road and the completed surface of the new road with as small a distance as possible traveled between these two sections.

It is, of course, always a desideratum to have the traffic detoured so that the contractor will be in full possession of the right of way at the points where construction is in progress. If, however, traffic must be maintained it is sometimes possible by means of a little rough grading to provide for it alongside the working points without serious inconvenience to the public or the contractor.

If the road is 18 feet or more in width it is also possible, if permitted by the engineer, to make it in two successive longitudinal halves, diverting the traffic first to half of the original roadway surface while the first half of the new road is built and then opening that to traffic while the second half is built alongside. Substantially the same procedure may be followed when the road is built, as has sometimes been done, with two one-way strips of concrete surface on each side and a narrow central strip of macadam, a type of construction which is considerably cheaper than a full width continuous concrete surface and is claimed to be at least equally desirable. Roads less than 18 feet in width can hardly be constructed in halves to advantage, and must, therefore, be completed full width at a single operation and the aggregate delivered accordingly.

If the contractor is reasonably assured of long-continued good weather in which he can work practically every day he must provide for the delivery and distribution of the aggregate accordingly and it must all be stored in advance or he must have certain assurance that it will be forthcoming regularly after the commencement of the work. If there is likely to be considerable inclement weather or predetermined interruptions to the work, it may be possible for him to arrange for the production and distribution of the aggregate during this time so as to reduce the maximum peak of production and transportation and the total amount of simultaneous storage.

If the right of way is wide enough and unobstructed the contractor may be able to distribute the aggregate in advance alongside the roadway, perhaps during the winter months, when other construction operations are prohibited and when his motor trucks and men have plenty of leisure. If such is the case, it may eliminate the question of central storage and of loading and unloading machinery that otherwise would be important.

In the selection and purchase of new equipment, such as industrial tracks and cars, dump cars, batch boxes, motor trucks, storage bins and loading and unloading apparatus the contractor must also be assured that such purchases will be delivered in time for the certainty of their availability promptly when required, because if they were missing when he was ready to commence the work or a certain portion of it, the entire schedule of operations would be dislocated and great loss and confusion might ensue. It should, therefore, be of standard design and furnished by the most reliable and well-established dealers.

In the decision between hand work and ma-

chinery and especially in the selection of the different kinds of plant and equipment, due weight should be given not only to the particular job for which it is purchased, but to the amount and character of the work the contractor has reasonable assurance of doing in the immediate future. If he can foresee considerable quantities of similar work and a strong chance that he can secure the contract he will be justified in buying special appliances that will be profitable in the long run, while they would not be advantageous for a small amount of work that might be done satisfactorily by hand at a somewhat larger unit cost and save the investment. In other cases he might find it more desirable to use general equipment that sufficed for the present occasions and was more adapted to miscellaneous construction in case there was uncertainty of his continuing road construction. In any event all of the equipment purchased should be thoroughly standardized and of as few different types and sizes as possible so as to make the units and pieces interchangeable, allow for a minimum number of spare parts and secure the greatest efficiency of operation by the workmen.

The unloading and storage of aggregate at a central plant can be handled by any of the various methods described in PUBLIC WORKS, pages 435 and 457, vol. 50, or by modifications or combinations of them less suited to the special conditions. The measuring of the aggregate at the central plant is very generally adopted and in most cases or all will be found to be more rapid, convenient and economical. The use of batch boxes for its transportations provide for the automatic measurements and convenient handling at both ends. These may be purchased from regular dealers or they can often be advantageously made of wood by the contractor's regular forces during the winter or in stormy weather or dull times.

If batch boxes are not used their equivalent can be used by transporting the materials in motor trucks, the bodies of which are separated by one, two or more swinging partitions with intermediate spaces holding a single batch of materials, provision being made for the successive dumping of these separately without one unit interfering with another. When this is not convenient the aggregate may be loaded into tilting buckets placed on a chassis or flat car or dumping by gravity when the latches are released.

If industrial tracks are used the dump cars should carry single batches or batch boxes should be loaded in sets of one, two or three on flat cars, and the flat cars or dump cars hauled in trains of suitable length with provision very carefully made for returning and outgoing trains to pass each other en route and for rapid continuous movement of full and empty cars both at the mixer and at the storage plant so that no time is lost in waiting for full or empty cars. Various arrangements of the industrial track can be made to secure the greatest movement and most convenient handling of the trains. They may sometimes form a loop around the storage plant and another around the concrete mixer, another may be provided with Ys and switches and crossovers or they may be double or single lines according to the amount of materials handled, the character of the right of way and the amount of track available.

If a continuous supply of aggregate is certain and a given number of cars or boatloads of it daily can be depended upon it is possible to keep only a small storage pile in reserve and to unload aggregate as received by a derrick and clamshell or by a locomotive crane running on a track between the railroad siding and the industrial track where the cars are and filling the latter as they arrive. Batch boxes are generally unloaded by a small derrick installed on the paver and the latter is universally charged with an elevating hopper, operated by its own power.

When the aggregate is distributed along the right of way in advance of the concreting it may be delivered to the paver by wheelbarrows or hand carts. There have, however, been put on the market loading and measuring machines that are installed adjacent to the paver and consist of some sort of a continuous belt conveyor or its equivalent that is easily fed by men shoveling from the piles alongside. This method saves considerable labor and makes for greater speed and continuity in serving the paver.

When a contractor has only a single job to execute and is already provided with a portion of the equipment necessary for the work he may be able to supplement it by some other equipment that he possesses or by purchasing only a small amount of additional equipment, as, for instance, when a contractor has only a few thousand feet of industrial track and has to haul a mile or more he may use the industrial track until the work progresses beyond its limits, and then establish at the end of this track a gantry or other lifting device by which the aggregate can be quickly transferred from the cars to trucks that will carry it the remainder of the distance and thus enable both the trucks and industrial tracks to be in simultaneous operation to advantage and with their combined efforts to handle nearly twice as much material as either could alone.

Newspaper Aid to Unemployment

The Toledo "Daily Blade" has offered to do its part in relieving the unemployment by publishing without cost notices of odd jobs that the Toledo citizens may want done, such as cleaning cellars or attics, raking leaves, cleaning furnaces, etc. These free notices will be printed under the caption of "Help Wanted, Odd Jobs." This would seem to be a practical aid in solving the unemployment problem which might well be imitated by newspapers in all cities throughout the country. The amount involved in these odd jobs is not sufficient to warrant the private citizens in advertising for help, and, in fact, they probably could obtain it without advertising; but the bringing of such odd jobs to the attention of those who are really anxious for work should prove of real assistance in enabling many to obtain it.

Recent Legal Decisions

COUNTY'S RIGHT TO SUE FOR CONTRACT PRICE OF BRIDGE DESTROYED BY WATER

The Kansas Supreme Court holds, Board of Commissioners of Trego County, 198 Pac. 954, that where a county contracts with a builder for the construction of a bridge on the county line and pays the builder the full contract price, although the adjoining county reimburses the contracting county for one-half of the contract price, the latter county may maintain an action against the builder for damages for the entire contract price where the bridge, on account of noncompliance with the plans and specifications, is destroyed by high water.

CONSTRUCTION OF STATUTE RELATIVE TO WARRANTS FOR 80 PER CENT OF WORK DONE

The Iowa Supreme Court holds that Code Supp., 1913, sec. 1989, art. 34, providing for the issuance of warrants to a drainage contractor for 80 per cent of the work done during the progress of the work on the engineer certifying the same is mandatory, the legislature evidently intending that contractors under this statute should not be required to wait until the completion and final acceptance of the work. For any sums claimed above the 80 per cent the contractor can sue in quantum meruit, and is not entitled to a writ of mandamus. The county might file a counterclaim for any injury suffered by the work not being completed to the satisfaction of the engineer, and would also have a right to an independent action on the contractor's bond.—Farmers' Loan & Trust Co. v. Wright County (Iowa), 183 N. W. 500.

DRAINS AND SEWERS DISTINGUISHED IN LEGISLATION AUTHORIZING CONSTRUCTION

The Ohio Supreme Court holds, Roebling v. City of Cincinnati, 132 N. W. 60, that, although in common usage the words "drains" and "sewers" are to some extent synonymous and interchangeable, when applied to public street improvements they are distinguishable, and legislation by the council of a municipal corporation under the Ohio statute for the improvement of a street by paving and providing for the construction of the necessary drains as an incident thereto, is not broad enough to clothe the city with jurisdiction to construct a sanitary sewer thereunder.

A drain, the court says, is an incident to street building. No engineer would think of constructing a street without providing for its drainage. It is an essential element of good workmanship and substantial construction, and it is highly important that drains be provided to prevent the accumulation of water upon the surface of the street and adjacent territory, for the purpose of preventing early decay and deterioration of the street. By reason of its construction a street may receive surface water, and frequently does, from territory outside of its own compass, from the terraces of abutting property and from the roofs of houses thereon.

The term "sewer," on the other hand, when applied to city improvements, means a large, underground passage for fluid and feculent matter —the refuse and filth necessarily present in populous centres—by means of which this matter is carried off. A sewer is employed for the convenience of the people, and its prime purpose is for the benefit of the health of the public.

FRANCHISE WATER RATES CONTROL THOUGH TEMPORARY CONTRACTS HAVE BEEN MADE WITH MUNICIPALITY

In an action against a municipality for water rates, it is held, Waterloo Water Co. v. Village of Waterloo, 189 N. Y. Supp. 906, that water rates fixed by a franchise to furnish water to a village and its inhabitants are controlling, and establish the rates to be charged, in the absence of any other agreement to the contrary, although contracts subsequent to the date of the franchise were made for limited periods during the life of the franchise for the same rates as those contained in the franchise. Even had they been at higher rates, they would have modified the franchise to that extent only for the period for which the contracts were made. The making of contracts from time to time was a practical construction that the village was obligated only for water that it used from time to time, the same as a private consumer, and not evidence of an intention wholly to nullify the provisions of the franchise as to rates to be charged.

ASSESSMENT OF BENEFITS NOT A TAX WITHIN THE STATUTE EXEMPTING CITY PROPERTY FROM TAXATION

The Connecticut Supreme Court of Errors holds, Whitmore v. City of Hartford, 114 Atl. 686, that, while an assessment of benefits is an exercise of the taxing power of the state, it is not a tax within the meaning of Connecticut General Statutes, par. 1160, exempting all property belonging to any city from taxation. While it is "in a general sense a tax, it is one of a peculiar nature. It is a local assessment imposed occasionally, as required, upon a limited class of persons interested in a local improvement, who are assumed to be benefited by the improvement to the extent of the assessment." Bridgeport v. New York, etc., R. Co., 36 Conn. 255. They stand apart from the general burdens imposed for state and municipal purposes, and are governed by principles that do not apply to the general levy of taxes. In addition to the common taxation, special assessments demand that special contribution, in consideration of a special benefit, shall be made by the persons who receive it. The demand for the special contribution is justified by the fact that those who are to make it, while they are made to bear the cost of the public work, are supposed to suffer no pecuniary loss thereby, because their property is increased in value to an amount at least equal to the sum they are required to pay.

NEWS OF THE SOCIETIES

Nov. 8 — WATERBURY BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce Hall. Secretary, J. R. Putnam, 64 Woodside ave.

Nov. 9—BALTIMORE SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Engineers' Club. Secretary, Prof. A. G. Christie, Johns Hopkins University.

Nov. 9—NEW ENGLAND WATER WORKS ASSOCIATION. American House, Boston, Mass.

Nov. 13-17—AMERICAN CIVIC ASSOCIATION. Chicago, Ill. Headquarters, 905-7 Union Trust bldg., Washington, D. C.

Nov. 14—METROPOLITAN SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with A. I. E. E., A. I. M. E. and A. S. C. E.

Nov. 14—NEW HAVEN BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Mason Laboratory, Yale University. Secretary, Prof. S. W. Dudley, 400 Temple st., New Haven.

Nov. 14 — NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies bldg., New York City. Sec., G. I. Rhodes. 115 Broadway, New York City.

Nov. 14-16—CITY MANAGERS' ASSOCIATION. Annual meeting. Chicago. Secretary, H. G. Otis, city mgr., Clarksburg, W. Va.

Nov. 14-18 — AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

Nov. 15—LEVEE AND DRAINAGE CONTRACTORS' ASSOCIATION. St. Louis, Mo.

Nov. 15-18—ATLANTIC DEEP WATERWAYS ASSOCIATION. Savannah, Ga. Headquarters, Real Estate Trust bldg., Philadelphia, Pa.

Nov. 16-18 — NATIONAL MUNICIPAL LEACUE. Chicago. Secretary, H. W. Dodd, 261 Broadway, New York City.

Nov. 17—AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Joint meeting with Society of Naval Architects and Marine Engineers. New York.

Nov. 17-18—SOCIETY OF NAVAL ARCHITECTS AND MARINE ENGINEERS. New York.

Nov. 17 — BRIDGEPORT BRANCH, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Chamber of Commerce.

Nov. 17—TOLEDO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Toledo Commerce Club. Secretary, Loring Freed, Atlas Chemical Co.

Nov. 17 — WORCESTER SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Worcester section, A. I. E. E. Secretary, Harry M. Latham, Crompton & Knowles Loom Works.

Nov. 21—CHICAGO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Joint meeting with Western Engineering Society.

Nov. 22 — ATLANTA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

Nov. 22—PHILADELPHIA SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Adelphia Hotel.

Nov. 25 — COLORADO SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Metropole Hotel, Denver. Secretary, William Lester, Vulcan Iron Works.

Nov. 28-29—KANSAS CITY SECTION, AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Two-day regional meeting. Secretary, Louis Bendit, 517 Finance bldg.

Dec. 1-3—MONTANA IRRIGATION AND DRAINAGE INSTITUTE. Great Falls, Mont.

Dec. 5-9—AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual convention. New York City.

Dec. 6-9—AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. 14th annual meeting. Baltimore, Md.

Dec. 14—NEW YORK SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Engineering Societies' building, New York City.

Dec., 22-23—KANSAS ENGINEERING SOCIETY. Hutchinson, Kan.

Jan. 4-14 — CLEVELAND, OHIO, BUILDING EXPOSITION. Municipal auditorium, Cleveland, Ohio.

Jan. 17-20 — AMERICAN ROAD BUILDERS' ASSOCIATION. Annual Convention and good roads show. Chicago, Ill.

Feb. 12-17 — CONFERENCE OF HIGHWAY ENGINEERING. 8th annual conference. University of Michigan, Ann Arbor, Mich.

Apr. 27-30—BUILDING OFFICIALS' CONFERENCE. Apr. 27-28, Cleveland, O.,; Apr. 29, Massillon, O.; Apr. 30, Youngstown, O.

May 15-19 — AMERICAN WATER WORKS ASSOCIATION. Annual convention. Philadelphia, Pa.

BROOKLYN ENGINEERS' CLUB

The October 27th meeting of this club took the form of a discussion of the proposed "Amendment No. 1" to the constitution of New York state, in which it is proposed to give to all veterans of the recent war preference over all others in civil service appointments. Past Commander Thomas Gannon of the New York state department, Spanish War Veeterans, took the affirmative and James J. Deasy the negative.

On October 29th an inspection trip was made to the new piers being constructed by the city of New York at Stapleton, S. I., where there are twelve large piers and sheds estimated at $18,000,000, affording five miles for wharfage 1,800,000 square feet of pier space. This work, which was begun in 1920, is now practically completed.

The regular meeting of Nov. 3 was Ladies Night, devoted to social pleasures at the Club House, and attended by many members and guests.

OFFICERS NOMINATED FOR AM. SOC. C. E.

The nominating committeee of the Am. Soc. C. E. has selected the following candidates for offices to be filled at the annual election on January 18th: For president, John R. Freeman; for vice-president, C. B. Grunsky and Robert Ridgway; for treasurer, Otis E. Hovey, and for directors, C. M. Holland, J. J. Yates, F. E. Winsor, John N. Chester, A. J. Dyer and W. L. Huber.

INDUSTRIAL RELATIONS CONFERENCE

A conference was held at Harrisburg, Pa., October 24-27, under the auspices of the Department of Labor and Industry, Commonwealth of Pennsylvania, Clifford B. Connelley, commissioner.

Preliminary session October 24th: Meeting of the approved boiler inspectors of Pennsylvania.

Monday evening: Address, The Honorable William C. Sproul Governor of Pennsylvania. Address, "The Present Industrial Situation," The Honorable J. J. Davis, Secretary of Labor, Washington, D. C.

Friday: Industrial Co-operation (The Four Factors in Industry), (a) The Employer (speaker to be announced); (b) The Employe, Mr. John A. Voll president, Glass Bottle Blowers' Asso., of United States. (c) The Public, George E. Mallwain, Babson's Statistical Organization. (d) The State, Honorable Edward E. Beidleman, Lieutenant Governor Pennsylvania.

The Foreign Outlook, Dr. Frederick Willson, Reading, Pa.

Women and Children in Industry, (a) Employment of Minors, Miss Mary Anderson, director, Women's Bureau, Bureau, Dept. of Labor, Washington, D. C. (b) Employment of Women and Minors. (c) The Massachusetts Forty-Eight Hour Week vs, the Eight Hour Day, Miss Ethel Johnson, Asst. Commissioner Dept. of Labor and Industries, Massachusetts. (d) Women and Welfare Work.

Tuesday evening 6.00 P. M., Women's Club of Harrisburg, meeting of the representaties of the Women's organizations of Pennsylania.

Stabilizing Industry and Employment, a) Samuel A. Lewisohn, New York. b) Prof. H. G. Moulton, University of Chicago.

Industrial Waste, (a) Unemployment, L. W. Wallace, Executive Secretary, Federated American Engineering Societies, Washington, D. C. (b) Industrial Disputes, Dr. Wm. Leiserson, Chairman, Board of Arbitration Men's and Boys' Clothing Industry, New York. (c) Accidents and Sickness, Cecil G. Rice, President Western Pennsylvania Division National Safety Council, Pittsburg. (d) Hiring and Firing (Industrial Turnover), Magnus Alexander, Managing Director National Industrial Conference Board, New York. (e) Fire Hazards.

Industrial Education (Education for a Better Job), (a) The Elementary and Secondary Schools, Dr. Wm. Davidson, Supt. of Public Instruction, Pittsburg. (b) The Uniersity or Technical Institution, Dr. John M. Thomas, President, Penna. State College, State College, Pennsylvania. (c) The Plant School. (d) The Labor Union College, Mr. John Philips, 2d Vice-President Penna. Federation of Labor. (e) School of Training of Women Workers (The Bryn Mawr College Experiment), Dean Hilda W. Smith, Bryn Mawr College.

Industrial Waste, The Honorable Herbert Hoover, Secretary of Commerce, Washington, D. C.

Industrial Publicity (a) The Daily Newspaper, J. Easton McKirdy, Pittsburg. (b) The Industrial Plant Magazine. A Ellis Frampton, Hammermill Paper Company, Erie. (e) The Technical Journal, Wm. W. Macon, Editor of "Iron Age." d) The Trade Journal, John Frey, Editor "Moulders' Journal.

Speakeers: Value of the Employe's Magazine, Miss Anna Bezanson, Dept. of Industrial Research, Univeristy of Penna.

Co-operation of the Industrial Editors with the State Department of Labor and Industry, Dr. C. B. Connelley Commissioner.

Medical Supervision in Industry (a) Industrial Medicine as a Factor in Industrial Efficiency. (b) The Maintenance of Community Health Dr. Edward Martin, Commissioner of Health, Harrisburg. (e) The Rehabilitation of the Industrial Cripple (illustrated by lantern slides and motion pictures), General Lewis T. Bryant, New Jersey Commissioner of Labor.

(Continued on page 370)

New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

POWER DRAG SCRAPER

The bottomless steel plate power drag scraper manufactured by L. T. Green is made in 8 sizes of ½ to 5 cubic yards capacity, weighing from 400 to 2,000 pounds each, and developing a pull of from 3,000 to 19,000 pounds on the load line and requiring from 12 to 150 h. p. of steam, gasoline or electric h. p.

The longer the haul, the larger sized scraper is suitable, and the corresponding capacities in one 10-hour day with a line speed of 250 feet per minute on the load line and 600 feet per minute on the return line vary from 350 to 117 cubic yards for a ½-yard scraper with 100 to 300-feet average haul, or for a 5-yard scraper the capacity varies from 3,500 cubic yards for a 100-foot haul to 700 cubic yards for a 500-foot haul.

POWER DRAG SCRAPER

The scraper is operated by any standard 2-drum hoisting engine and will dig and convey to any desired point without expensive overhead equipment. It will load wagons, trucks or cars; deliver materials to belt conveyors or bucket elevators: handle storage, strip over burden from pit, and successfully handle any kind of material from soft mud to hard clay. It is claimed to be the most economical device for handling hillside deposits and in many cases is adaptable for reclaiming material under water. The first cost and operating cost are low and the manufacturers offer to send the scraper on trial where there are hoists and other equipment competent to handle it.

The standard equipment necessary for the operation of a 1-yard power drag scraper at a reach of 350 feet from hoist, consists of 300 feet of 6 x 19 plow steel wire rope, four wire blocks with grease cups, 84 cable clips, 6 shackles, one 75-foot bridle cable, three 60-foot guy cables, five 25-foot cables for dead men slings and one 2-drum friction hoist.

P & H EXCAVATOR CRANE SHOVEL ATTACHMENT

The Pawling & Harnischfeger Co. have just put on the market a new shovel attachment, adapted for use with their No. 205 or 206 excavator crane, which, when substituted for the standard boom of this machine, effects great economy and convenience and enables the one machine to be used for shovel excavating, dragline excavating, backfilling and all-around material handling with grab buckets, scrapers, eletromagnets, sling chains or grapples. In addition, the skimmer boom may be employed for some kinds of road and street work.

The Shovel Attachment is so designed as to make it possible to interchange it with the standard boom of the 205 or 206 Excavator Crane with but few changes necessary.

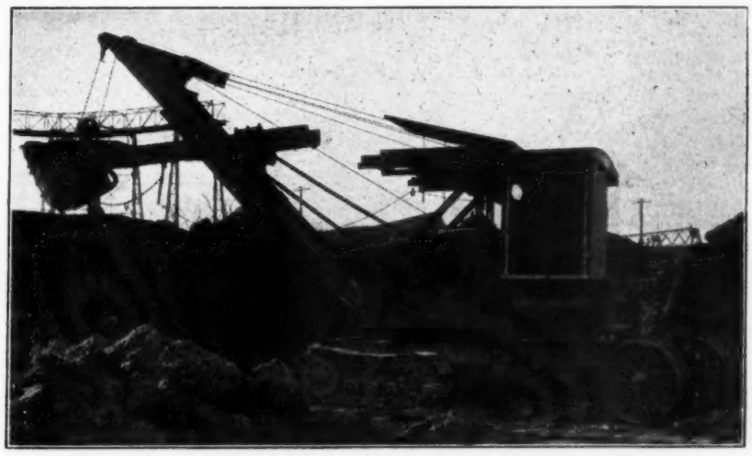
With the new attachment one machine may, therefore, be used for all-round material handling, drag-line excavating, shovel excavating, and for back filling with grab bucket, Page bucket, scraper, electro magnet, sling chains, and grapples. In addition to this a skimmer boom may be employed for some kinds of road and street work.

The box section boom is constructed of rerolled structural steel plates, so designed that all the rivets are driven from the outside and readily accessible. The boom foot is a single annealed steel casting, securely riveted to the structural members.

The shipper shaft is a high carbon steel forging with annealed cast steel, bronze bushed bearings and saddle blocks provided with renewable cast iron slide plates.

The ½-yard dipper has a steel plate shell, front, lip, and door; annealed cast steel back, forged teeth with hardened points, and forged hinges. The cast steel dipper handle, designed to straddle the boom, consists of two members each having an oak core, armored with steel plates on all four sides. The dipper handle racks are manganese steel castings. All pin joints on both dipper and handle are bushed with hardened steel bushings.

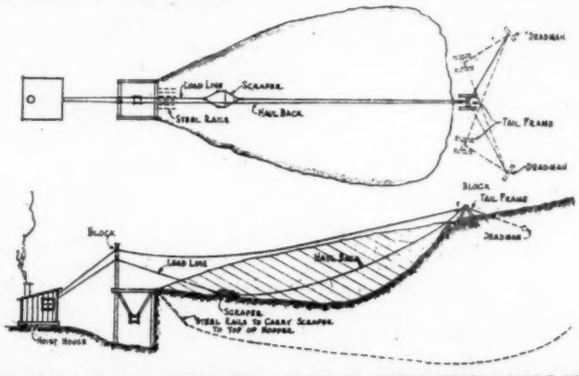
The Shovel Attachment is operated by standard levers on the machine, with the exception of an additional brake attachment to one of the brake treadles.



GENERAL CONSTRUCTION SHOVEL ATTACHMENT INSTALLED ON EXCAVATOR CRANE

This attachment can be quickly removed in case it is desired to re-convert the machine into a dragline or for operation with a clamshell bucket.

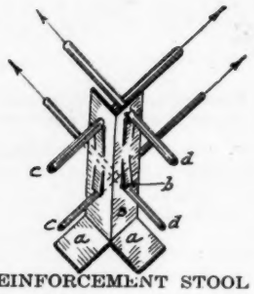
The Shovel Attachment conforms to the standard of steam shovel practice, and will dig continuously and at high speed, any material which can be handled by a steam shovel of similar weight.



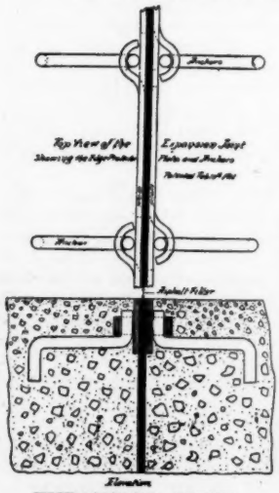
TYPICAL INSTALLATION FOR EXCAVATING FROM HILLSIDE AND LOADING CARS, TRUCKS, CONVEYOR OR ELEVATOR

REINFORCED CONCRETE PAVEMENT STOOLS AND JOINTS

The Thomas Steel Reinforcement Co. has issued a 48-page book, describing the construction of the "Thomas System" of reinforced concrete pavements that do not crack, with special attention to the little Hercules stool



REINFORCEMENT STOOL



EXPANSION JOINT PROTECTION AND ANCHORAGE

for supporting and automatically gripping the reinforcement rods with "Sure Anchor" edge protection for expansion joints.

The stool is made from short lengths of No. 6 angle bars, having the flanges split apart and bent at right angles to form a stable base, and holes and tongues punched in both vertical flanges so that the reinforcement bars may be inserted and then rigidly held in place by closing the tongues against them, an operation that is positive, efficient, and performed with great rapidity and simplicity by single hammer blows.

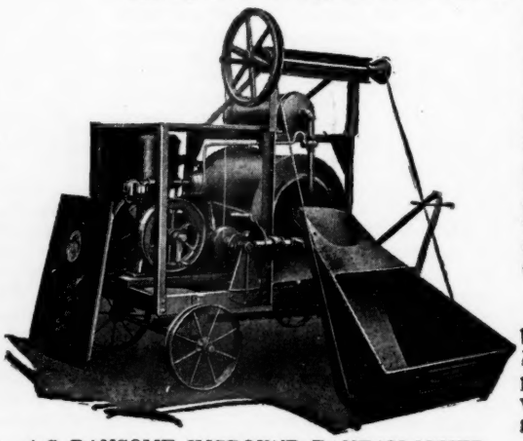
The expansion joints of any required type are protected by a pair of special flat steel bars on opposite sides of their upper edges. These bars have spring tongues punched in them to engage anchor rods that can be instantly connected to them without the use of special tools and will secure them firmly in position under all conditions of the joints.

The manufacturers offer tool boxes containing gas pipe forms so that any size reinforcing frame can be made to fit any width roadway with proper tools to pinch the bars in the stools, and will send experienced men to get first jobs started, and break in men to make the frames at the bare cost of time and expenses.

RANSOME BANTAM MIXER

The number 4-S Ransome Improved Bantam Mixer has all of the general advantages of the original Bantam and some special features that make it particularly adapted for small foundations, culverts, and sidewalk building, for mortar mixing and similar classes of work. It is a sturdy, light, portable machine providing thorough mixing action wth fast discharge. The driving gears are of the Maag type that are very strong with a long line of contact that provide a maximum of rolling contact and minimum of sliding contact. have an easy action and an enlarged surface for resisting wear.

All castings are made from aluminum patterns, insuring smoothness and accuracy and interchangeability of the parts. The support of the drum is special in that two of the rollers are very close together providing substantially a three-point suspension that insures perfect bearing over all irregularities. The machine is equipped with a fixed chute or side loader, operated by its 3 h. p. engine. It weighs 3,650 pounds, has a housing, removable on three sides and requires about three pints of gasoline per hour for its operation.



4-S RANSOME IMPROVED BANTAM MIXER

INDUSTRIAL NOTES

The Albert Grauer Co., manufacturers and contractors for sidewalks, lights, mastic floors and skylights, has opened offices at the Builders' Exchange in Cleveland, Ohio.

The Holt Mfg. Co. of Peoria, Ill., has appointed W. A. Bickel as district manager in charge of the consolidated territory of Iowa and Nebraska.

The Cortland Machinery & Equipment Co., Inc., has been organized with offices in New York City, to specialize in the sale of saw mills, logging tools, power machinery, etc.

The Chain Belt Co., Elyria, Ohio, has opened offices in Buffalo, N. Y., with T. E. Crocker as district manager.

The Wisconsin Construction Co., general contractors and engineers, has changed its name to the Paul C. Kroeck Co.

S. P. Rees, formerly with the Pittsburgh Filter & Engineering Company of Pittsburgh, Pa., has been made manager of the Municipal Filtration Department of the International Filter Co., First National Bank Bldg., Chicago.

RANSOME COMPANY'S NEW PLANT

On Oct. 6 the Ransome Concrete Machinery Co. of Dunellen N. J., broke ground for an addition to their present plant which will increase their manufacturing space 54 per cent.

The 53 x 320-ft. new building contains huge electric cranes running the entire length of the factory and capable of handling any but the very largest concrete mixers made by the Ransome Company. The machine shop and erecting floors will be equipped with the most modern machinery including portable air and electric equipment.

(Continued from page 368)

Workmen's Compensation (a) Progress in Compensation The Honorable Robert E. Lee, Chairman, Workmen's Compensation Board, Maryland, and President of the International Workman's Compensation Boards and Commissions. (b) Compensation Legislation, John B. Andrews, Secretary, American Association for Labor Legislation. (c) Interstate Commerce and the Supreme Court of the United States, The Honorable Harry A. Mackey, Chairman Pennsyvania Workmen's Compensation Board.

SAFETY EXHIBITS

An Industrial Welfare Exhibit was held for the display of material relating to industrial efficiency, such as fire prevention and protection, safety devces, illumination, first aid, health, hygiene, welfare, etc.

The Museum of Safety Appliances of the Department of Labor and Industry was opened to the public for the first time. This exhbit included over three hundred safety appliances of all types that hae been approved by the State Industrial Board.

NEW ENGLAND WATER WORKS ASSOCIATION

The November meeting of this Association will be held at the American House, 56 Hanover St., Boston. Wednesday, November 9, 1921.

PROGRAMME

11:00 A. M.—Meeting of the Executive Committee at the Headquarters, Tremont Temple.

1:00 P. M.—Lunch will be served at the American House.

2:00 P. M.—Paper: "Steam Boilers," by F. W. Dean, Boston, Mass. Illustrated). Topical Discussion, Frank J. Gifford, Secretary, Dedham, Mass.

PERSONALS

Southgate, W. W., city engineer, and Capt. George Reyer, superintendent of water works of Nashville, Tenn., have become members of the Nashville board of public works.

Dormant, Francis L., city engineer of Houston, died on October 12th

Anderson, G. B., has been transferred by the department of public works from Ottawa to Sault Ste. Marie, Ont.

Sylvster, S. deputy minister of public works, Quebec has resigned after holding the position for twenty years.

Cappelen, F. W., city engineer of Minneapolis, Minn., died on October 16th.